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THE

TRANSACTIONS

OF

THE LINNEAN SOCIETY

OF

LONDON.

VOLUME XVIII.

LONDON:

PRINTED BY RICHARD AND JOHN E. TAYLOR, RED LION COURT, FLEET STREET:

SOLD AT THE SOCIETY'S HOUSE, SOHO-SQUARE;

AND BY LONGMAN, ORME, BROWN, GREEN, AND LONGMANS, PATERNOSTER-ROW;

AND WILLIAM WOOD, TAVISTOCK-STREET, COVENT-GARDEN.

MDCCCXLI.

MISSOURI
BOTANICAL
GARDEN.

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Uvularia Leschenaultiana. *Wall. Cat. n.* 5089.

Hab. in Peninsulæ Indicæ montibus Neelgherries dictis (*Leschenault, Wight*); in Emodi montibus ad Mussooree. *Royle.* ♃. (v. s. sp. in Herbb. Wall. et Royle).

Caules erecti, ramosi, sesqui- v. bipedales. *Folia* ovata, acuminata, imâ basi constrictâ longiùs subpetiolata, 3-pollicaria, sesqui- v. 2 pollices lata. *Umbella* sessilis, 3- v. rariùs 5-flora. *Flores* virides. *Pedicelli* semunciales et ultrà. *Sepala* ovato-lanceolata, acuta, vix semipollicaria, basi gibbosa, vix saccata. *Antheræ* obtusæ, filamentis infernè dilatatis ferè duplò breviores. *Stigmata* revoluta, stylo ter breviora. *Ovarium* turbinato-trigonum.

The specimens in the Wallichian Herbarium of this very distinct species were collected by the late M. Leschenault de la Tour in the Neelgherries, a considerable range of mountains in the Indian Peninsula. The shorter leaves, sessile umbels, broader sepals, gibbous only at their base, and the greater comparative length of the style, will readily distinguish it. Dr. Royle's specimens from Mussooree in the western Himalayas have the leaves longer, and the flowers larger, but they otherwise agree with those from the Neelgherries.

6. *D. Pitsutum,* umbellis pedunculatis 7—9-floris, sepalis cuneato-lanceolatis obtusiusculis basi gibbosis, antheris filamentis ter brevioribus, stylo stigmatibus duplò longiore, foliis lanceolatis subpetiolatis.

Disporum Pitsutum. *Don Prodr. Fl. Nepal. p.* 50. *Schult. fil. Syst.* vii. *p.* 371.

Uvularia Pitsutu. *Ham. MSS.*

U. umbellata. *Wall. in Asiat. Res.* 13. *p.* 379. *Cat. n.* 5090.

Streptopus peduncularis. *Sm. in Rees' Cyclop. sub Uvulariâ.*

Hab. in Nepaliâ ad Chitlong (*Buchanan Hamilton*); ad Chisapany. *Wallich.* ♃. (v. s. sp. in Herbb. Smith et Wall.).

Caules erecti, ramosi, bi- v. tripedales, crassitie digiti minoris. *Folia* lanceolata, longè acuminata, 3—5-pollicaria, semunciam lata, subtùs ad nervos scabriuscula, imâ basi constrictâ subpetiolata. *Umbella* pedunculata, 7—9-flora. *Pedunculus* vix uncialis. *Pedicelli* scabriusculi, pedunculo longiores. *Flores* lutescentes? *Sepala* cuneato-lanceolata, obtusiuscula,

In my younger days I never found myself at a loss to distinguish *Arundo* from *Avena* on the one hand, or from *Agrostis* on the other, or *Festuca* from *Triticum*; yet I now observe that many species of *Avena* and of *Agrostis* have hairs at the base of the florets, and that in *Arundo* they are not always long. The hairs of *Avena fatua*, *A. sterilis*, &c. cover great part of the outer palea, and are more rigid than in *Arundo*; but the hairs in *Arundo* are not strictly confined to the base, and *Avena setacea* has soft hairs rising from the base to more than half the length of the palea. They are both absolutely and relatively longer than those of *Arundo* (*Deyeuxia*) *sylvatica*. *Avena* has a jointed awn twisted at the base; but this is also the case, though less obviously, in some species of *Arundo*. Again, *Aira* is distinguished from *Avena* by having only two flowers, but *Avena subspicata*, *A. setacea*, and some others have hardly, if ever, more than two flowers. The characters of *Avena* and *Bromus* in the English Flora seem to differ only in the adhesion of the seed in *Bromus* to the inner valve alone of the corolla, while in *Avena* it is said to be united to both valves. This peculiarity is not found in all the species of *Avena*, in some of which the seed, though inclosed in the hardened paleæ, is not united to either. Yet Sir J. E. Smith is among the botanists who are most exact in their descriptions, and most careful to make them contain some points of difference. That the outer palea is somewhat more rolled in at the edges, and the inner somewhat more ovate, in *Avena*, are minute and comparative points of difference, hardly sufficient for the foundation of a genus, even if they were more constant than I find them to be.

The manner in which a single species is transferred by different authors to different genera shows that I am not singular in finding great difficulties in this particular. *Arundo tenella* is an *Agrostis* with Rœmer and Schultz. *Holcus*, as separated from *Sorghum*, is united by De Candolle to *Avena*, while Kunth places it among the *Phalarideæ*. *Bromus pinnatus* of Linn. and of Eng. Bot. became *Festuca pinnata* with later botanists, and the alteration was afterwards adopted by Smith himself. Haller called it *Triticum*, in which he is followed by De Candolle. P. de Beauvois formed for it a separate genus under the name of *Brachypodium*, from the short stalks on which the spiculæ are placed. Mertens and Koch, after paring away many species from this genus, still left in it *B. pinnatus*, and some other closely allied perennial

grasses. Later still, Kunth in his valuable work on the *Gramineæ* has arranged all these with *Triticum,* while the annual small-seeded *Tritica,* which had been united by some authors to *Brachypodium,* are referred by him to *Festuca.* He has also referred to *Festuca* the *Sclerochloa* of P. de Beauvois, some of which are plants which Smith had separated from *Poa* to add to *Glyceria,* and he leaves to the latter genus only two European species, *G. fluitans* and *G. aquatica,* plants not in habit closely allied, yet certainly very similar in the structure of their florets.

The number of genera of grasses described by Kunth is 235, embracing 3034 species. No one can have all these at once present to the mind, and it therefore becomes necessary to adopt some method which may bring them before us in regular succession or in tribes. Linnæus founded his primary divisions on the number of florets in a common calyx, and their arrangement in a scattered manner, or in a regular spike, making some exceptions, and adding in one or two instances some other character, in order to avoid any violent opposition to nature. His system obliged him to disperse some genera into different classes ; but in those included in the class and order *Triandria Digynia* he has endeavoured, in numbering the genera, to show something of their natural affinities in a consecutive series. In the English Flora, where the genera are less numerous, it appears of less consequence to make a complete arrangement; but Sir J. E. Smith has followed the example of Linnæus in a double distribution, arranging the genera at first according to a definite character, and when he comes to the species, placing them in an order more nearly corresponding with their natural affinities. No art, however, can reduce the genera of grasses into a simple natural series. The Linnean botanists of the continent of the present day do not seem in general to trouble themselves with this double order, but are contented to number and place the genera as they are distributed by the artificial character, and in this they have been followed by Dr. Hooker. Palisot de Beauvois, observing the defects of all former arrangements, published in 1812 an "*Essai d'une Nouvelle Agrostographie.*" In this he divides the grasses into two great families, in the first of which the spiculæ or locustæ are all alike, each containing either perfect florets, or florets which unitedly contain all the parts necessary for the reproduction of the plant. The second contains those plants where

some of the spiculæ are unproductive. These families are each divided into two tribes, dependent on the axis or flower-stalk, which in the one is entire and continuous, in the other toothed and jointed. The glumes or valves of the calyx are, in the first tribe, inserted alternately; in the latter they are described as "*parallelle insertæ.*" Referring to the genera enumerated under each head, in order to find the exact force of these terms, we find all our one-flowered grasses in the first, except *Nardus* and *Lepturus,* together with *Bromus, Avena, Poa, Dactylis,* and some others; while *Glyceria, Sclerochloa, Festuca,* and others nearly allied are in the second. I confess myself completely baffled by this result, and quite unable to discover what it is which is common to one tribe and not to be found in the other. The tribes are divided into cohorts, as the spiculæ are 1- 2- or many-flowered, and as the florets are individually perfect or incomplete; and in the second family, according to the position of the separated spiculæ in the same or in different panicles or spikes. The cohorts are variously divided into sections; and these are again subdivided by means of the arms; *i. e.* by their absence or presence, whether awns or setæ, rising *from* the extremity, *near* the extremity, from the back, or from near the base of the corolla or stragulum. What I have already said will show that this arrangement has the effect of widely separating genera very closely allied. It has also the other, of bringing together genera whose affinities are comparatively slight. *Imperata,* for instance, stands in the same section with *Paspalum* and *Milium*; *Erianthus* is placed with *Calamagrostis* in another; *Sporobolus, Oryza,* and *Knappia* occur together in another. *Agrostis* is divided into *Agraulus,* which is placed in the 3rd group; *Vilfa,* which is in the 6th; *Agrostis* in the 10th; and *Apera* in the 13th; *Phleum* is with *Spartina* and *Chloris* in the 11th; *Donax* and *Sesleria* stand together in the 27th. The author frequently insists on his genera or groups being natural, but he evidently only means by this that each has a clear and distinct character. P. de Beauvois has introduced several new terms, and uses some of the old ones in a peculiar way. Most of the writers on this part of botany have acted in some degree in a similar manner. I will, therefore, before proceeding any further, explain a few of the principal, both as used by others, and as I have adopted them myself.

Axis, with P. de Beauvois, is the part of the culm, above the upper knot,

supporting the locustæ or spiculæ. Other botanists, among whom we may reckon Kunth, apply the term *axis* to the stalk supporting the separate florets within the calyx, and it is in this latter sense that I have used it.

Locusta is the word used by Ray, and adopted by P. de Beauvois and by Brown for what Linnæus called *spicula,* and Sir J. E. Smith a spikelet. I feel the want of a word which may be applied with equal propriety to this part in the one-flowered grasses as well as in the many-flowered, but am unwilling to adopt a term already applied to two distinct objects in natural history. I have therefore made use of spicula, even when there is only one flower.

Glume. According to Linnæus the calyx of grasses is a *glume* composed of two valves. Jussieu also uses the term glume as expressive of the whole organ. P. de Beauvois, on the contrary, names the whole *tegmen,* (or in French, bâle,) and describes it as consisting of two glumes. Kunth also calls each part a glume, and I follow him in this as the most convenient nomenclature. As to whether or not it should be considered as a calyx, this must be determined on the general principle of applying that term to the common envelope of a compound flower, or confining it merely to a simple one. If we determine upon the latter, we have ready for us the word involucrum; but as some grasses have another exterior covering, to which we can hardly apply any other term than involucrum, I have preferred following the terminology of Linnæus, which is sanctioned by custom, without undertaking to defend its strict propriety. Some botanists have contended that these glumes are abortive florets, and there can be no doubt that in some genera abortive florets do assume the appearance of glumes. In *Ampelodesmus* the inner glume is said sometimes to become a barren floret. Both circumstances tend to show the close affinity of these organs.

Palea. Within the glumes we arrive at the *paleæ.* With Linnæus these are the *valves* of a corolla. This part is called *stragulum* by P. de Beauvois, and said to consist of two *paleæ.* In the *Botanicon Gallicum* the term *glumæ* is applied to the outer coverings, and *glumellæ* to the interior, and this also is the phraseology of Mertens and Koch. Gaudin calls the outer envelope a calyx of two *paleæ,* and the inner a corolla of two *paleolæ.* I think it an objection to these diminutives that the inner covering is very frequently the largest. Kunth calls these interior valves *paleæ,* and this is the expression

which I adopt. He does not seem to have found it necessary to assign a name for the two together. I shall with Linnæus term it a *corolla,* but composed of two *paleæ* instead of petals. This nomenclature seems more unobjectionable than that of calyx to the outer covering; and if Mr. Brown has not absolutely proved, he has at least shown it to be highly probable that these parts are analogous to the outer series of a hexapetalous corolla.

Awn. Attached to the outer palea we frequently find an awn, whose presence nature and position are often very useful in determining species, and sometimes in characterizing genera. Palisot de Beauvois maintains that two organs essentially distinct have been confounded under this name. To one of them he applies the name of seta, and describes it as the prolongation of a nerve, whose base forms part of the substance of the paleæ. It is not necessary that it should accompany the paleæ for the whole length of the latter, but may divide from it in any part. The awn originates suddenly from the substance of the palea, and if there should be a nerve below, it is much smaller than the awn, and is considered to be prolonged into a *seta* embraced by the awn and adhering closely to it. When broken off, the awn leaves behind no trace of its existence. Neither Duby nor Kunth seems to acknowledge this distinction. Gaudin adopts it with some modifications. P. de Beauvois has added to the above characters that the *awn* is stronger than the *seta,* and of a firmer texture. Gaudin, on the contrary, shows that the *awn* is frequently as fine, tender and delicate as any *seta,* as in *Aira* and *Agrostis,* which are acknowledged to be awned by P. de Beauvois himself; and, on the other hand, in *Triticum,* where both authors are agreed that the terminating point is a *seta,* it is firm and thick, so that few awns can exceed it. He takes, therefore, principally for his guide its fragility at the point of insertion. P. de Beauvois assigns a seta to *Festuca* and *Brachypodium,* and an awn to *Bromus.* Gaudin considers all these genera as setigerous. The nature of the *arm* may doubtless afford sometimes a very useful distinction, but I am afraid it will be impossible to regard it as including two things which can always be clearly distinguished. The *seta* is a mere continuation of the midrib. The *awn* is something different or something more; the peculiarity pointed out by Gaudin will usually explain its nature.

Scales; Squamulæ. Within the outer paleæ, but without the stamens, are

frequently some small scales, which Linnæus called nectaries, but which are considered by some botanists as forming the true corolla of grasses, and by Mr. Brown as vestiges of the interior series of a hexapetalous corolla. They are the *lodiculæ* of P. de Beauvois, and the *glumellæ* of Richard. *Squamula* is adopted by Kunth, and seems unobjectionable, as simply describing the object, without determining its use or involving any theory of its origin.

Mr. Brown* has proposed a division of the grasses into three unequal groups, founded on the tendency of the genera to perfect the lower, the upper, or only the central floret. In the first group the number of florets is uncertain. When there is only one, the outer valve of the corolla is at the inside of the outer valve of the calyx. When there are two or more, they are either all perfect, or the imperfection is in the upper florets. In the second group the florets are either one or two; the more perfect floret being always next to the inner valve of the calyx. The third group has a perfect intermediate floret, and one on each side either barren or still further reduced to a single valve. The first contains the majority of the European grasses. The second, *Sorghum, Andropogon, Saccharum* and *Panicum*. The third, *Hierochloa, Anthoxanthum*, and perhaps *Phalaris*.

Where the object in view is an arrangement to facilitate the progress of the student, we ought carefully to describe appearances. But in taking more scientific views on the subject, we may be allowed to determine the nature of a part by analogy, and pronounce that to be an abortive floret, which to unpractised eyes appears to be only an additional glume. And perhaps in grasses the most simple way is to consider every additional part without the palea as the indication of an abortive floret. The tendency of certain plants towards a particular structure, even when the structure is not developed, is very important, and was perhaps first distinctly implied in the observations of Mr. Brown; but we must be careful in following this distinguished naturalist not to push our theories too far, nor decide upon this *tendency* without the support either of a very close analogy, or of some indications in the plant itself. Where there is no certain and definite character, different persons will judge of relationship in very different manners. What seems clear and unquestionable to one is very doubtful to another: and in arranging groups

* This statement is taken from the English Flora.

from a general sense of comparative similarity, no two botanists would perhaps exactly agree. Thus *Arrhenatherum*, placed by Linnæus among the *Avenæ*, and declared by Sir J. E. Smith to be an *Avena* in habit, is transferred by many botanists to *Holcus*. De Candolle, or at least Duby, in a work to which De Candolle's approbation is attached, and to which his name is added, solves the difficulty by putting *Holcus* and *Avena* into one genus. But according to Kunth, *Holcus* does not belong to the *Avenaceæ* but to the *Phalarideæ*; and as the barren flower of *Arrhenatherum* is the lowest, this genus would belong technically to the second section of Brown, while both *Holcus* and *Avena* belong to the first; and Kunth, though he places *Holcus* with the *Phalarideæ*, yet fixes *Arrhenatherum*, in spite of its outer barren floret, among the *Avenaceæ*. In these indeterminate problems, if I may use the expression, no individual can be very confident that he is in the right, but the question in each particular case will at last be determined by the adherence of the men of the clearest and most comprehensive views, and who have most carefully studied the subject. At present, in the grouping of Grasses, we seem to stand but on the threshold; and while one distinguished botanist invites us in one direction and another in another, the bewildered student is at a loss which to pursue.

Reichenbach, though he has distributed his Grasses into tribes, has probably given his attention more to the determination of species than to the arrangement of genera. His groups are nearly the same as those of Kunth, and the variations which he has introduced are not for the better.

I mention Kunth last, as it is his grouping which I propose nearly to adopt as to the natural arrangement of the genera; and I begin with this part of the subject, because it is the careful consideration of natural affinities which must guide us in the choice of the characters on which each genus is to be established.

This author, in the work to which I have already referred, divides the Grasses into 13 tribes, which, however, he hardly attempts to characterize. He gives no explanation of the motives which induced him to put plants into the same tribe, or to separate them into different ones; nor is it easy to extract such motives from the short and loose description which he has prefixed to each tribe, and which, short and imperfect as it is, is generally contradicted

in the characters of some of the included genera. An arrangement of this sort, where reasons are not given, will almost necessarily depend in some degree upon the idiosyncracy of the person who makes it, and will, therefore, at times appear arbitrary and fanciful to others; for peculiar characters, analogies, and affinities will strike different minds with very different degrees of force. His tribes are:

1. *Oryzeæ*, comprising 13 genera and 61 species, of which, among European plants, we find only 2, *Leersia oryzoides* and *Oryza sativa*.
2. *Phalarideæ*, 18 genera, among which are *Lygeum*, *Zea*, *Crypsis*, *Knappia*, *Alopecurus*, *Beckmannia*, *Phleum*, *Phalaris*, *Holcus*, *Hierochloa*, and *Anthoxanthum*.
3. *Paniceæ*, 32 genera, comprising *Milium* (*effusum*), *Panicum*, *Oplismenus*, *Setaria*, *Pennisetum*, and *Lappago*. *Digitaria* is included in *Panicum*. This is the largest tribe in respect to the number of species, which is 859. Of these, *Panicum* alone has 421.
4. *Stipaceæ*, 8 genera. Those I have to notice are *Piptatherum* (separated from *Milium*), *Achnatherum* of P. de Beauvois (called by Kunth by the compound name of *Lasiagrostris*), and *Stipa*.
5. *Agrostideæ*, 16 genera. The European ones are *Coleanthus*, *Sporobolus*, *Agrostis*, *Gastridium*, and *Polypogon*.
6. *Arundinaceæ*, 9 genera, including *Calamagrostis*, *Deyeuxia*, *Ammophila*, *Arundo*, *Ampelodesmus*, and *Phragmites*.
7. *Pappophoræ*, 7 genera. Only 1 species, *Echinaria capitata* (*Cenchrus capitatus*) is found in Europe.
8. *Chlorideæ*, 22 genera. I have of these, *Cynodon*, *Dactyloctenium*, *Leptochloa*, and *Spartina*.
9. *Avenaceæ*, 19 genera, among which we find *Corynephorus*, *Deschampsia*, *Aira*, *Airopsis*, *Lagurus*, *Trisetum*, *Avena*, *Arrhenatherum*, and *Danthonia*.
10. *Festucaceæ*, 38 genera. The European ones are, *Sesleria*, *Poa*, *Glyceria*, *Catabrosa*, *Briza*, *Melica*, *Molinia*, *Kœleria*, *Schismus*, *Dactylis*, *Cynosurus*, *Lamarckia*, *Festuca*, and *Bromus*.
11. *Hordeaceæ*, 8 genera, comprising *Lolium*, *Triticum*, *Secale*, *Elymus*, *Hordeum*, and *Ægilops*.

12. *Rottboelliaceæ*, 11 genera, 3 of which occur within my limits, *Nardus*, *Psilurus*, and *Lepturus*. This latter genus includes the European species of *Rottboellia*.
13. *Andropogoneæ*, 26 genera. *Imperata*, *Erianthus*, and *Andropogon* are all with which I am concerned. The last-mentioned genus is made by Kunth to include *Sorghum* of Smith.

Of this distribution we may observe, that the structure of *Lygeum* is so peculiar that we can hardly gain any thing by uniting it with others into a particular tribe, and that *Zea*, although described as having an external neutral floret in the fertile spicula, has yet no very striking general similarity with *Phalaris*, and still less with *Alopecurus* and *Phleum*, or these with *Holcus* and *Anthoxanthum*. *Knappia*, with its flowers on a one-sided rachis, may possibly be more nearly allied to the *Chlorideæ*, where it is placed by Reichenbach: yet on the whole I am disposed to keep it in the neighbourhood of *Agrostis*. Among the *Paniceæ*, *Milium effusum* seems oddly introduced between the two closely allied genera *Paspalum* and *Panicum*. To make out its claim to a place in the *Paniceæ*, we must suppose that of the two very similar outer glumes, which are usually considered as forming the calyx, one only deserves that name, while the other is to be taken as an abortive floret. These suppositions (unsupported by any peculiarities in the construction) may afford grounds for ingenious speculations, but they can hardly be made use of as parts of a generic character; or, to use the words of De Candolle, "such an hypothesis may be convenient if considered as an image or a metaphor, but can hardly be allowed as an expression of reality."

Kunth has not only scattered into three genera the species of the Linnean genus *Milium*, but he has placed these in three different families. *Milium effusum*, retaining the ancient name, is, as we have just seen, put among the *Paniceæ*; *M. cærulescens*, *M. paradoxum*, &c. form the genus *Piptatherum*, which is one of the *Stipaceæ*; and *M. lendigerum*, under the name of *Gastridium*, is found among the *Agrostideæ*. The *Arundinaceæ* consist entirely of genera formed out of the Linnean *Arundo*. The *Chlorideæ* are, perhaps, not very closely allied, at least there seems little affinity between *Cynodon* and *Spartina* except in the inflorescence. *Kœleria* among the *Festucaceæ* trenches very

closely on *Trisetum* among the *Avenaceæ*, yet I think the line of division is correctly drawn. On the other hand, *Brachypodium* and some other plants render very faint and obscure the separation of the *Festucaceæ* and *Hordeaceæ*.

In considering what forms a group of genera, it is necessary to determine those points in their structure in which all, or the greater part of them agree, in order that we may not depend for distinction on marks which run through a great many groups. This seems sufficiently obvious in all classification; yet probably every botanist would be able to produce examples where genera have been founded, or species formed, on characters which are common to numbers. We determine a plant to be a Grass, by its knotted culm, each knot giving rise to a striate sheath, which terminates in a leaf of similar texture. These leaves are generally narrow; but as there are plants with broadish leaves, *i. e.* the breadth of which is as much as half their length, which every botanist would without hesitation pronounce to be Grasses, it appears that this circumstance is not essential to our notion of a Grass. Another essential particular is in the flower, which is uniformly *glumaceous*, a term which on the present occasion it cannot be necessary to explain. Without a structure of this sort a plant would not be a Grass, nor would it be esteemed such unless it had a single monocotyledonous superior seed not inclosed in a capsule or pericarp.

These circumstances being common to all Grasses cannot be made use of in distinguishing genera, or the tribes into which we may incline to distribute the genera; but there are various particulars in the infloresence and in the distribution and structure of the glumes and palea, and in the organs of reproduction to which we can refer for this object. The infloresence is in most cases reputed to be too uncertain in its nature to form a good foundation for the establishment of genera; but in Grasses, where the genera are, perhaps, formed in many cases for the convenience of the student, rather than because nature has established any marked difference between them, I know of no botanist who has been able to do without it. Even the pubescence of certain parts, a character in general of little value even in the determination of species, has been universally admitted as part of the character of a genus. If in these cases we must take care not to push the license too far, nor to conclude, because a peculiarity in some plants coincides with other circumstances, so as to form a valuable groundwork for the separation of genera, that it must do

so in all others, it is only a caution to be attended to in all cases, and a compliance with the very just and important Linnean maxim,—that the genus must give the character, but a character does not constitute a genus.

The general inflorescence of Grasses is very various. *Zea* is the only genus which has any pretence to a place in the *Flora* of middle Europe, where that of the barren* and fertile flowers is different; the former being a terminal panicle, the latter an axillary spike. It is even, I believe, the only one where there are fertile florets devoid of anthers. In other genera the spiculæ are either scattered in a loose panicle, or in a compact or spike-like one; or they are in a real spike or head, in which the florets are tiled equally all round; or they are in opposite rows; or they are in two rows on the same side of the common rachis, which in that case is usually flattened to receive them, and more or less triangular. The panicle is also sometimes disposed equally all round, or the branches are placed more on one side than the other, so as to leave one part of the circumference destitute of florets. We must add, that the spiculæ are either solitary or disposed in pairs or groups, and that in these groups the spiculæ are all sessile, or sessile and stalked. The spiculæ themselves are either all perfect, or some barren or neuter, and others perfect, and they contain only one floret and nothing more; or one floret and the rudiment of a second; and this rudiment is either below or above the perfect floret; or they have two florets, or more than two florets.

From the combination of these particulars we find among Grasses the following modes of inflorescence.

1. Spiculæ solitary, 1-flowered, or with not more than the stalk-like rudiment of a second, which, when it occurs, is on the side of the inner or upper glume, and therefore the indication of a superior floret, disposed in a panicle (either loose or spike-like), equal all round. This is the arrangement in *Leersia* and *Oryza*, in the Phleineæ of the following pages, in Stipaceæ, Agrostideæ, and the one-flowered Arundinaceæ.

2. Spiculæ 1-flowered, or with only an imperfect external rudiment of a second, placed in pairs or groups in a panicle equal all round. This is the disposition of the florets in the *Lygeum*, in the Andropogoneæ, (except in

* I use *barren* to express spiculæ or florets which have only anthers; *fertile*, where there are only pistils; *perfect*, where there are both; *neuter*, where there are neither.

some species of *Andropogon* itself.) where in some genera the sessile spiculæ are perfect, and the stalked ones barren. Pairs or groups of spiculæ occur also in *Digitaria*, but on a one-sided rachis, and in *Elymus* and *Hordeum*, where they are on a rachis with opposite channels.

3. Spiculæ solitary, in a panicle, with a rudiment or imperfect floret within the outer glume of the calyx, or even with a rudiment or imperfect floret on each side, but below the perfect floret. This description applies to all the Phalarideæ except *Lygeum* and *Zea*, which have only a doubtful claim to a place in that tribe, and to *Arrhenatherum*. Among the Oryzeæ also several of the foreign genera are described as having indications, more or less complete, of an imperfect inferior floret, though the two European genera exhibit nothing of the sort. *Ctenium* among the Chlorideæ, and some of the Rottboelliaceæ, are said to have external imperfect florets or rudiments, which, however, occur in no European genus of these tribes. *Panicum* also would be included under this head.

4. Spiculæ in two rows on one side of a flattened rachis. This is the inflorescence of the remaining European Paniceæ and of the Chlorideæ. It occurs, as already stated, in most species of *Andropogon*, in *Nardus*, and in *Cynosurus cristatus*. In *Knappia* the rachis is not flattened or triangular. *Triticum*, *Nardus*, and *T. unilaterale* belong to this division, and perhaps *Oreochloa*.

5. Spiculæ with more than one perfect floret disposed in a panicle equal all round. This contains the remaining Arundinaceæ, the Avenaceæ, except *Arrhenatherum*; and among the Festucaceæ, *Poa*, *Glyceria aquatica*, *Catabrosa*, *Melica*, *Molinia*, *Kœleria*, *Schismus*, and *Bromus*.

6. Spiculæ in a one-sided panicle. In other respects like the last. This contains the remainder of the *Festucaceæ*, except *Sesleria*, which belongs to the following.

7. Spiculæ in a spike or head, tiled all round. Here we place *Echinaria* and *Sesleria*.

8. Spiculæ in opposite rows, on an alternately channeled rachis. This division includes the *Hordeaceæ* and *Rottboelliaceæ*, with some exceptions, which have been already noticed. The description would also apply to *Festuca maritima* (*Triticum maritimum*, Auct.), and *F. divaricata*, and to *Gaudinia* (*Avena*) *fragilis*.

I have already noticed *Zea* as the only Grass within my limits where the barren and fertile flowers are on different parts of the plant. I may add, that it is the only one where there are no spiculæ containing all the parts necessary for the reproduction of the plants. *Hordeum, Andropogon,* and *Sorghum* have distinct antheriferous spiculæ mixed with the perfect ones. *Holcus, Hierochloa,* and *Arrhenatherum* have barren florets containing anthers only, mixed with the perfect ones in the same spicula. The *Phalarideæ* and *Paniceæ* have one or two abortive external florets; this occurs also in *Phragmites,* and sometimes in *Ampelodesmus.* The addition of an upper abortive floret occurs in many Grasses, as well in the many-flowered ones as in those which have but one perfect floret, and perhaps may serve as an accessory in determining the genus of a Grass, though I think it cannot always be depended upon even as a specific character.

Passing from the external to the more central parts of the plant, we find that the glumes are wanting in *Leersia, Coleanthus,* and *Nardus.* They are separated by a short stalk from the lower floret in *Oryza, Stipa* (except in *S. aristella*), and *Cynosurus aureus,* solitary in *Lolium, Psilurus,* and some species of *Lepturus.* On one side of the spicula in *Elymus, Hordeum,* and the remaining species of *Lepturus,* and in some degree in *Ægilops.* The general arrangement presents us two glumes on opposite sides of the spicula, but one sometimes a little lower than the other, the inner or upper being rather the largest. The terms *inner* and *outer* with respect to glumes may be used either in relation to the spicula to which they belong, or to the spike or branch of which the spicula forms a part. In the first case, *outer* and *lower* would be equivalent; in the second, the *lower* glume becomes the *inner* one in, I believe, all cases where it can be precisely determined, except among the *Rottboelliaceæ.* We see it clearly in *Lolium*; but in most of the spiked Grasses, where the arrangement is most evident, the position of the glumes seems to be equidistant from the general centre. To avoid ambiguity, I use with Kunth the terms *upper* and *lower* as applied to individual spiculæ, *inner* and *outer* to the more general inflorescence. Of the paleæ we must speak always with reference to the spicula of which they form part, and the terms are synonymous. The comparative size of the glumes is taken for granted in the description of most Grasses. It is enough to notice the exceptions where they occur. The outer

usually embraces the base of the inner; but in *Phalaris* and *Achnodonton*, by the help of the position and direction of the lateral nerve, they have the appearance of being almost valvular. The only genera in which the outer glume is the largest are, *Milium*, *Achnatherum*, *Gastridium* and *Calamagrostis* and *Deyeuxia*. The substance of the glumes is sometimes of use in determining genera; but on this head there seems to be a great difference in the terminology of different authors, and perhaps few authors are always perfectly consistent with themselves, expressing the same character by different words in different places, and even different characters apparently by the same word. Thus the glumes of *Milium* are *membranous* according to Kunth and Gaudin, *herbaceous*, if we consult Hooker. The paleæ of the same plant are *subcoriaceous* in Kunth, *cartilaginous* in Gaudin. Kunth applies alike the term *membranaceous* to the paleæ of *Alopecurus* and of *Phalaris*, though the consistence is certainly very different. I find these parts of Grasses described by different authors as *carnosæ*, *cartilagineæ*, *coriaceæ*, *chartaceæ*, *papyraceæ*, *herbaceæ*, *membranaceæ*, *scariosæ*, *hyalinæ*, *tenerrime membranaceæ*, and with different compounds of these terms. I distinguish

Filmy. Very thin and transparent. The paleæ of most species of *Andropogon* and *Sorghum* may be taken as examples of this degree of solidity. The palea also of *Knappia*, and the inner palea of the neutral floret of *Oplismenus*, and the inner palea of some species of *Agrostis* and of other Grasses.

Scariose. Transparent, like the preceding, but firmer: it exists in the paleæ of *Phleum*, and of many other Grasses, and in the glumes of *Polypogon* and *Stipa*.

Membranous. Still firmer; translucent but not transparent, and often coloured (but not green). We find it in the glumes of *Agrostis* and *Arundo*, in the paleæ of *Poa nemoralis* and *Glyceria aquatica*.

We may use the compound term Membrano-scariose for an intermediate state, as in the glumes of *Deschampsia cæspitosa* and of *Avena pubescens*.

Herbaceous. Green, and nearly of the texture of a leaf, as in the barren floret of the *Paniceæ*. This perhaps differs more in colour than in substance from membranous.

Here, again, we may employ the compound terms Herbaceo-membranous and Herbaceo-scariose to denote the intermediate states. The first occurs in the glumes of *Phalaris*, and in the paleæ of *Poa annua*; the second, in the glumes of *Anthoxanthum*, and the glumes and paleæ of *Trisetum*.

Coriaceous. Thicker and firmer than membranous, as in the paleæ of *Phalaris*.

Coriaceo-membranous would express an intermediate degree of consistency, as in the paleæ of *Milium effusum*. Herbaceo-coriaceous would denote a difference of colour and texture rather than of substance; we have it in the paleæ of *Sclerochloa rigida* and *Triticum loliaceum*.

Horny. Harder than coriaceous. The paleæ of *Andropogon Allionii* may well deserve this title, at least when the plant is in seed, nor would it be misapplied to the paleæ of *Panicum*, or the glume of *Sorghum saccharatum*.

Fleshy. This term may be applied to the additional scales which indicate the exterior florets in some species of *Phalaris*, and to those of the interior floret in *Melica*, but perhaps not correctly to either glume or palea.

The shape of the glumes and paleæ, considered as flat surfaces, does not appear to afford us any good generic characters; but their being navicular, compressed, concave, nerved, furnished with a marked midrib, or ribbed, are particulars to be attended to. In this respect also I find considerable difference in the use of words. We have *canaliculatæ*, *carinatæ*, *carinato-compressæ*, *naviculares*, *naviculari-carinatæ*, *concavæ*, *concavo-compressæ*, *naviculari-compressæ*, *involutæ*. *Concave* and *carinate* seem by most authors to be placed in opposition; but Smith unites in the same description *concave* and *keeled*. In considering the substance of a plant, I understand the compound terms, such, for instance, as *herbaceo-membranaceous*, to indicate an intermediate state; but in the foregoing examples it would be hard to say what idea was intended to be expressed by a form between *boat-shaped* and *keeled*. Mertens and Koch prefer considering the glume as convex instead of concave.

The structure of the valve in this point of view consists of several particulars unconnected with each other, which may or may not be combined, but where in many cases we cannot with propriety speak of an intermediate form. A navicular or boat-shaped glume is one so closed at the ends that it cannot be opened into a flat surface. We find this in degree in the glumes of many

Grasses, but we do not notice it unless it occur in a remarkable degree, as in the glumes of *Phalaris* and *Beckmannia*. This may be accompanied with a keel, as in the first instance, or be without one, as in the second, and consequently a form may be both navicular and keeled (*glumæ naviculares carinatæ*), but not intermediate between them.

The distinctions which appear to me to be useful are:

Involute. The margins turned in, as in the paleæ of *Stipa*, and perhaps of most of those Grasses where the outer palea hardens on the seed.

Concave. Rounded at the back, as in the paleæ of the *Paniceæ*. This occurs sometimes where the organ is nerved or ribbed, as in *Glyceria aquatica*, but rarely where there is a keel or midrib decidedly stronger than the other ribs.

Compressed. The two sides meeting in an angle at the back; this generally, but not necessarily includes a midrib. The outer paleæ of *Poa* and *Dactylis* may furnish examples.

The first of these may exist in union with either of the others, and to any of them a keel may be added: two or three terms may therefore be used in the same description, but they should not be compounded.

In some Grasses we find the glumes or paleæ of even texture throughout; in others we find *nerves*, as in the paleæ of the *Paniceæ*, where they are quite unaccompanied by any elevation of the surface. I cannot call these striæ, because there is in some cases a closely and uniformly striated surface; yet they show themselves only in colour. In others we find, as in *Glyceria*, *Eragrostis*, and some species of *Poa*, sharply prominent nerves, and in others, as *Sclerochloa*, a thick rounded nerve, or almost indeterminate thickening of the substance with intermediate hollows, which do not seem always deep enough to be called furrows. The first of these I call nerves, the latter, ribs. In all these cases the outer palea, to which these particularities of description chiefly apply, has a central nerve or prominence, to which I do not give the name of midrib, unless it be stronger or more prominent than the others.

The inner palea has usually two ribs, at which the membrane is folded in upon the parts of fructification. While in flower it almost uniformly follows the curve of the outer palea, at least in Grasses where the spicula has more than one flower, till the swelling of the seed forces it into a line concave

within. The exceptions from such an arrangement are all that it is necessary to notice.

An additional glume is found in some Grasses (the *Paniceæ*, for instance,) an additional palea in others (as in *Sorghum* and *Phalaris*), or at least additional parts putting on these appearances. These are always to be considered as abortive florets. They arise in some cases so precisely at the same point with the perfect floret, that it might be difficult to decide whether they ought to be considered as inferior or superior, if we had not a guide in their position, whether within the inferior or superior glume. In the first case, it must be the rudiment of an inferior, in the latter, of a superior floret. In fact, however, all the cases which might at first appear doubtful are distinguishable by the nature of the adjunct, the lower floret assuming the form of a sessile valve or scale, while the upper is always stalked, and frequently reduced to a mere stalk, which is not even constantly thickened at the top.

Within the paleæ are the *squamulæ*, the nectaries of Linnæus. These are often somewhat fleshy scales, but in many genera they are thin and scariose or filmy, putting on the appearance of minute paleæ; they are usually two, and are met with lobed or entire in the same genus, and I believe even in the same species. In *Imperata, Lygeum, Anthoxanthum, Crypsis, Alopecurus, Coleanthus,* and *Nardus* they are wanting, as they are also in most species of *Spartina* and in *Sesleria tenella.*

The stamina of Grasses are usually 3. *Psilurus* and some species of *Festuca* have only 1; *Imperata, Anthoxanthum,* the terminal floret of *Hierochloe, Crypsis aculeata,* and one species of *Bromus* have 2; *Oryza* has 6. These are all the exceptions that the limits of my work require me to notice. The anthers are oblong, notched at each end, except in *Lygeum*, and perhaps one or two more genera.

The germen seems to afford no character which is not better developed in the seed.

The stigmas are usually 2, sometimes sessile, or nearly so, sometimes on lengthened styles. These styles are united into one in *Sesleria*; and this seems to me to be the case also in *Imperata*; nevertheless, where there are two stigmas, most botanists seem agreed to place the plant in the order *Digynia. Nardus* and *Lygeum* have each only one stigma. Mr. Brown, from his obser-

vations on *Glyceria*, seems disposed to place some reliance on the simple or branched filaments which compose the stigma; but from Kunth's work, as well as from what little I have been able to examine myself, I should doubt if this could be trusted as a generic distinction.

The seed in some cases is entirely detached and of itself falls out of the paleæ; in others it is inclosed by, and falls off with them, but without adhering to either; sometimes it is attached to the upper, and sometimes to both paleæ. It is sometimes furrowed, and sometimes has an even surface; is sometimes crested, and sometimes hairless; sometimes linear and thin, sometimes thick and turgid. All these particulars are useful in the formation of genera, yet perhaps hardly any so constant as to prove at once a difference of genus.

The tribes I propose are the following:

1. Andropogoneæ.
2. Paniceæ.
3. Oryzeæ.
4. Phalarideæ.
5. Phleineæ.
6. Agrostideæ.
7. Stipaceæ.
8. Arundinaceæ.
9. Chlorideæ.
10. Avenaceæ.
11. Festucaceæ.
12. Hordeaceæ.
13. Pappophoreæ.
14. Rottboelliaceæ.

In discriminating these tribes, and the genera which they contain, I have endeavoured to give such characters as will apply to the plants of Europe. My knowledge is too imperfect to enable me to hope to seize correctly the distinguishing marks of those of more distant regions. Where a character occurs only in one genus of a tribe, or in one tribe among the Grasses, I mark it with a note of admiration: this plan renders it unnecessary to mention under the other tribes or other genera that such a particular is wanting.

Andropogoneæ.

The proper characters of this tribe seem to be, that the spiculæ are in pairs, one sessile and one stalked, or, at the extremity of each branch, in threes, of which two are stalked. The sessile spiculæ are always perfect, containing one perfect floret and the palea-like rudiment of another. The stalked spiculæ

are barren in some genera and perfect in others. The glumes are firm, nearly equal, inclosing the paleæ, which are thin, and often filmy, but bearing a strong awn. The inflorescence is panicular, except in *Andropogon*, where most of the species produce their spiculæ in two rows on the same side of a flattened rachis; and the spikes or racemes thus formed are frequently disposed in pairs or digitate. Flowers in determinate sets occur among the *Paniceæ*, which, however, are easily distinguished by the coriaceous paleæ. They are also found in *Hordeum*, and in some foreign genera among the *Rottboelliaceæ*. *Elymus* and *Lygeum* have two or three spiculæ together, but they offer nothing of a systematic arrangement.

The genera of this tribe may be thus disposed:

A. Spiculæ all fertile, clothed with long silky hairs. Glumes thin.

1. *Saccharum*. Paleæ unarmed, the inner small or wanting. Squamulæ 2. Panicle not spike-like.
2. *Imperata*. Paleæ 2, unarmed. Squamulæ none. Panicle spike-like. Rachis abruptly flexuose, continuous.
3. *Erianthus*. Outer palea awned. Squamulæ 2. Panicle spreading. Rachis hardly flexuose, very brittle.

B. Lateral or stalked spiculæ barren.

4. *Andropogon*. Spiculæ linear-lanceolate, compressed. Seeds nearly linear.
5. *Sorghum*. Spiculæ ovate or ovato-lanceolate, turgid. Glumes of the fertile floret coriaceous or horny. Seed roundish.

The second and third genera were struck off from *Saccharum* by Palisot de Beauvois. The true *Saccharum* has, as it appears from this author, only one palea and no awn or seta.

Imperata and *Erianthus* differ, as stated above; but these distinctions are not sufficient to constitute genera unless supported by a marked peculiarity of habit; and where we have only one species of a genus, as in *Imperata*, we can hardly acknowledge some difference of general appearance to decide the question, since we have no proof of its having any connection with the character. I may add to the foregoing description of *Imperata*, that in all my specimens the styles are united in the lower part. The very tough and horny

glumes and large swelling seeds of *Sorghum* appear to me to separate it sufficiently from *Andropogon*, and the habit is very different. Yet Kunth unites them, and Brown seems to rest their distinction exclusively on the inflorescence, which in *Andropogon* is usually in one-sided spikes, often in pairs or digitate, while *Sorghum* has an equal, diffuse panicle. I must confess that the glumes of *A. Allionii* and of *A. Gryllus* are, when in seed, nearly as hard as in *Sorghum*, though not so thick and solid, but the glumes of *Sorghum* are hard even while the plant is in flower.

Paniceæ.

These have two glumes, one of which is generally much smaller than the other, and sometimes reduced to a hardly distinguishable rudiment. Within these we find what appears in the European genera to be a third glume, but which analogy teaches us to consider as the rudiment of a barren exterior floret. In *Oplismenus* we may sometimes observe within this rudiment a filmy palea; and, in several tropical species of the tribe, this part is furnished with anthers. This barren floret seems to do the duty of a glume in the protection it affords to the fertile one. The paleæ of the latter are very firm and coriaceous or horny. They are dotted, or quite smooth, rounded or almost flattened at the back, without midrib or prominent nerve; but nerves are in some species distinguishable in colour, especially towards the apex of the palea. The European genera are as follows:

A. Spiculæ in two rows on one side of a flattened rachis.

1. *Digitaria.* Spikes fingered, unarmed.
2. *Oplismenus.* Spike compound; one-sided in the whole and in each part. Spiculæ naked.

B. Spiculæ not on such a rachis.

3. *Setaria.* Spike compact, cylindrical. Spiculæ surrounded by an involucrum of simple bristles!
4. *Pennisetum.* Spike compact, cylindrical. Interior bristles of the involucrum feathery!
5. *Panicum.* Spiculæ in a scattered panicle, unarmed. Glumes and abortive paleæ of similar texture.

6. *Lappago.* Spiculæ on short spikes in a raceme. The uppermost tabescent. Outer glume filmy; inner coriaceous, prickly. No abortive floret.

Paspalum is not a European genus, but it seems necessary to notice it on account of its close affinity with *Digitaria.* "A *Panico* distinctum," says Kunth, "nonnisi glumâ inferiore plerumque abortiente." Kunth puts *Digitaria* with *Panicum.* The term *plerumque* must in such a case be interpreted as admitting an accidental defect, not as a specific mark; that in *all* species it *usually* exists, but is in some *occasionally* wanting; for if this be the *only* distinction, it is evident that a species uniformly possessing the inferior glume must be a *Panicum* and not a *Paspalum.* In the same way I should explain the "glumæ rarissime 2" in the generic character of *Paspalum.* On reverting, however, to the species, we find that the glumes of this genus are always mentioned in the plural. It would certainly be clearer, where there is only one glume in a spicula, to mention it in the singular; but supposing this to be merely a looseness of expression, we can yet, I think, hardly understand "glumis flosculo longioribus" to apply to a single glume; and in the descriptions of no less than 48 species of *Paspalum,* two glumes are explicitly mentioned, or at least an inferior glume is mentioned, and the superior, as we know, is always present. The lower is not even always a very small glume, since we find in *Paspalum distans* and *P. inæquivalve* "glumâ inferiore flosculo dimidio breviore," and in *Paspalum fuscescens,* "glumis æquilongis paleâ inferiore paulo brevioribus." *Paspalum fuscum* is described "glumis subæqualibus;" *P. ligulare* and *P. brevifolium,* "glumis æqualibus." Is it that the author in these cases, after explaining the structure of the flower in the generic description in his own words, has, in carelessly copying preceding writers, called that a glume in the account of the species, which he had previously explained to be the palea of an inferior abortive floret? This however is not all, for the lower glume of the spiked and digitate *Panicums* (*Digitarias*) is described in different species as *exigua, minuta, minutissima, brevissima, minima, obsoleta,* and in Panicum tenuiflorum, *obsoletissima.* In *Pan. propinquum* the glume is *univalvis,* and in *Pan. gibbosum* and *Pan. phæotrix* the lower glume is *nulla.*

Another apparent distinction is offered to us by Kunth in the generic cha-

racters. He says of the paleæ of *Paspalum*, "inferior superiorem binerviam amplectens;" of those of *Panicum*, "inferior superiorem parinerviam amplectens." If by *parinerviam* we are to understand that the interior palea has the same number of nerves as the exterior, it would be a curious distinction, and in opposition to the general structure of the flowers of Grasses, which requires a central rib in the outer palea and rejects it in the inner. This, however, does not agree with the fact, and we must therefore suppose him to mean that the nerves of the interior palea are in pairs, and that there is consequently an even number of them, and this would not exclude the "paleam binerviam" of *Paspalum*. In those *Panicums* which I have examined I find two nerves and no more in the interior palea. On the whole, I confess myself unable to make out any difference between *Paspalum* and *Digitaria*, for the spiculæ of the former seem always to be disposed in rows on the same side of a flattened rachis as in the latter; and the spiculæ, as far as I can make out, are sometimes, but not constantly, in pairs in both genera.

In our species of *Digitaria* the lowermost spiculæ in luxuriant specimens are three together; the upper ones are usually solitary; the intermediate ones, forming the greater number, are in pairs, one of which is sessile, or very nearly so, and the other stalked. This genus, as I have already said, is not admitted by Kunth; and indeed the one-sided digitate spikes, which form at once so evident and so beautiful a character, would not, on the generally received principles of botanical science, be acknowledged as a sufficient mark of separation. Sir J. E. Smith seems rather to have endeavoured to deceive himself into a belief of the difference between *Panicum* and *Digitaria* by placing *Digitaria* among the one-flowered, and *Panicum* among the two-flowered Grasses, than to have been really convinced of it. And while *Digitaria* has an additional glume to the calyx, and the additional floret of *Panicum* is reduced to a single valve, so very much like an additional glume that Sir James does not attempt to give any mark by which they may be practically distinguished, we cannot admit a separation merely on this ground Sir W. Hooker adds, that the flowers are in unilateral spikes, and this is the distinction I am contending for; and I think we may be allowed to use the word spike with this latitude, though some of the florets are evidently stalked.

Oplismenus has a small point to the outer palea, and the nerves of the inner

glume and of the outer palea of the abortive floret meet each in a point, which in many cases is prolonged into a seta. *O. Crusgalli* has, I believe, always a filmy inner palea to the neutral floret, but it does not appear that this is constant through the genus. A comparison of Kunth's descriptions of the genera *Panicum* and *Oplismenus* leaves no distinguishing mark between them, except the "glumæ et paleæ muticæ" of the former, and "paleæ mucronatæ et glumæ plerumque aristatæ" of the latter. A mark of this sort is not often to be depended on among Grasses, and with the qualifying adverb it seems to be a very slight distinction. This learned author is amazingly careless in his divisions, whether of tribes, of genera, or of species, as to whether the description contain, or do not contain, a *differentia*: he seems in all cases to trust rather to the general habit of the plant and to his own tact, than to any decided or describable character.

Setaria. Sir J. E. Smith says, that the bristle-like involucrum is not sufficient to form a generic character. I am glad to seize anything which separates a group of plants which have a peculiar appearance. The smaller spikes, where the whole is compound, have something of a one-sided appearance, but I think rather from their position than from their structure. The whole inflorescence is, I believe, invariably alike all round. Since there is a marked habit, I am not willing to throw this genus back again into *Panicum*: how far it may be rightly separated from Pennisetum I will not venture to decide, but I have high authority for keeping them distinct. In the European species the leaves are rough and the sheaths smooth, bearded at the mouth.

I follow Kunth, rather than my own judgement, in placing Lappago among the *Paniceæ*, but I do not know where else to put it. The outer glume is broad-based, but small, and so thin that it is often difficult to detect it. The inner is hard and prickly. This difference of structure might give some ground to consider the latter as an abortive floret; but as the thin valve is towards the rachis of the spike, and therefore probably the inferior glume, analogy does not support us in this view of the subject. The inflorescence is in small spikes, not quite sessile, on a five-channeled rachis, each spike springing from an angle and having a channel above it. A difference in the direction of the parts gives to the whole the appearance of a one-sided raceme. The spiculæ grow all round the rachis of these short spikes; there are two or more of them,

of which the two lowermost, and very rarely a third, are fertile; one is, I believe, always neuter, and sometimes a second.

There is no other genus in the European Flora which can be associated with this tribe, for *Cynodon*, though resembling *Digitaria* in habit, wants the trace of an abortive exterior floret. It is true that in the one-glumed species of *Digitaria* it might be difficult to determine that the second valve was anything but a superior glume, but the rudiment of a superior floret in *Cynodon* will assist our judgement at least in rejecting that genus from the present tribe.

Oryzeæ.

It would hardly be allowable to draw up any character of this tribe from the only two European species which it contains. These agree in having the spiculæ scattered in a loose equal panicle, each of one perfect floret, without any additional rudiment either internal or external. The glumes are small and distant, or wholly wanting. The paleæ are of equal length, nearly valvular, membrano-herbaceous, the outer deeply concave and boat-shaped. The foreign genera assigned to this tribe by Kunth have florets of different sorts, or at least an evident, though, perhaps, very imperfect rudiment, but none have more than one perfect floret in the spicula. I have only to notice,

1. *Leersia.* Glumes 0. Outer palea ribbed. Stamens 3.
2. *Oryza.* Glumes 2, not precisely opposite. Outer palea ribbed and grained as if woven. Stamens 6.

The small and apparently inefficient glumes distinguish this tribe from our other single-flowered Grasses. *Coleanthus*, indeed, has no glumes, and probably on that account has been placed in this tribe by Reichenbach; but the paleæ of unequal length, one embracing the other, and the small size and delicate appearance announce a greater affinity with the *Agrostideæ*. The glumes are wanting also in *Lygeum* and *Nardus*, but neither of these plants approach in other respects to the *Oryzeæ*.

Phalarideæ.

I only admit into this tribe such plants as show a tendency to produce one or two external imperfect florets, and no indication of a superior one; the

outer palea of the perfect floret being always within the outer glumes. The glumes are large, nearly equal, completely inclosing the florets. I have admitted amongst them *Zea* and *Lygeum* without being able to give a good reason for doing so. The latter especially seems to me to have little relationship to the rest of the tribe; but I follow Kunth, since I know not where to place them better.

1. *Phalaris.* Glumes navicular, carinate, herbaceo-membranous, including. External florets, scale-like, neuter. Paleæ coriaceous, closely investing the seed.
2. *Anthoxanthum.* Glumes membranous, including. External florets neuter, each of one large palea, both of them awned. Perfect floret diandrous. Paleæ scariose.
3. *Hierochloa.* Glumes membranous, thin. External florets triandrous. Perfect floret diandrous. Paleæ firmer than the glumes.
4. *Zea.* Barren florets 2 in a spicula, disposed in a terminal panicle. Fertile floret 1 in each spicula, with external abortive rudiments disposed in a dense lateral spike.
5. *Lygeum.* Glumes 0. Spiculæ all fertile, in pairs or threes, uniting at last to form a 2- or 3-seeded nut.

Phalaris has in most species two small fleshy scales at the base of the perfect floret, often tipt with hairs, and I think I can sometimes discern traces of a filmy interior palea. In *P. canariensis* the additional floret is larger and more like the paleæ of the perfect floret both in size and substance than it is in any other European species.

I have no hesitation in considering the parts which used to be described as the corolla of Anthoxanthum as abortive florets, because I think the presence of a midrib and central awn a very strong proof that the upper of these cannot be an interior palea. This genus and Hierochloa I am quite disposed to place with the *Phalarideæ*; but I find it more difficult to say why Arrhenatherum should not also be placed amongst them. It has, however, only one barren floret, without any rudiment or indication of a second, and the fertile floret is consequently placed within the superior glume as in the *Paniceæ*. Kunth attributes to it the filiform rudiment of a superior floret, which is not

noticed by other botanists, and which I have not been able to find, yet there is a small callus, which perhaps is peculiar to this grass, whose nature I do not well understand.

Phleineæ.

I separate these from the *Phalarideæ* on the principle explained by Brown, because they have a tendency to produce an interior instead of an exterior floret, and also on account of the thinness and delicacy of the paleæ. Where no indication of an interior floret is observable, we are content to notice that there is no symptom of an exterior one, and to judge of the tendency by analogy. There is only one perfect floret in a spicula. The glumes are nearly equal, and include the paleæ. The inflorescence is in a spike-like panicle tiled all round, and this, perhaps, forms the most marked distinction between this tribe and the *Agrostideæ*, although the paleæ in the latter tribe have usually more consistency. The genera are:

1. *Achnodon.* Glumes boat-shaped, nearly equal, three-ribbed, the lateral ones meeting when closed so as to give the glumes a valvular appearance, and a spindle-like form to the whole spicula. Paleæ 2, nerved, filmy, unarmed.
2. *Phleum.* Glumes parallel on the midrib, which is prolonged into a seta, embracing, and forming an oblong spicula; paleæ 2, nerved, filmy or scariose, unarmed.
3. *Alopecurus.* Glumes membranous. Palea 1, scariose, awned at the back. "Styles combined." *Sm.*
4. *Crypsis.* Glumes and paleæ membranous, of similar substance and length, unarmed.
5. *Gastridium.* Glumes membranous, including, acute, awnless, ventricose at the base. Paleæ scariose or filmy. The outer truncate; awn dorsal, or none.

The boundaries of the two genera Phleum and Phalaris have somewhat shifted their position since the time of Linnæus. His character of *Phleum* is "Calyx truncatus, mucronatus." That of Smith, "Cal. of 2 close parallel pointed valves concealing the corolla of 2 awnless valves." Hooker omits the parallelism of the valves, which, however, is a striking character if understood

of the midribs, and gives to the spicula of this genus, as I understand it, an appearance very different from that which we find in Achnodon. Gaudin and Kunth describe a subulate rudiment to several species, but except in *P. Michelii* I have not been able to detect it. In *Phleum Gerardi* of Villars I can discern no inner palea; and I think in habit as well as in the dorsal awn of the palea it agrees better with *Alopecurus* than with *Phleum*.

Alopecurus. In some species of this genus the glumes are united at the base, and in some the inner edges of the single palea are united so as to form a tubular corolla, but neither of these characters runs through the genus. Crypsis is placed by Kunth among the *Phalarideæ*, and its dense panicle has obliged me to place it here, but its comparatively large and firm paleæ might perhaps vindicate for it a station among the *Agrostideæ*. These tribes, however, are so closely allied that I have more than once doubted the propriety of keeping them separate. The thin paleæ and dense spike unite in inducing me to transfer Gastridium from the *Agrostideæ* to this tribe. Palisot de Beauvois, indeed, ascribes to this genus coriaceous paleæ; and Sir J. E. Smith by his remarks on *Milium*, with which he unites it, seems to hold the same opinion. I find, however, the paleæ of both species to be as described by Kunth "tenuiter membranaceæ," and that in all stages.

Some species of *Polypogon* might seem to belong to this tribe, but we cannot divide the genus. The comparatively strong geniculate and twisted dorsal awn of *Lagurus*, with the two lengthened points of the outer palea, show it to belong to the *Avenaceæ*.

Agrostideæ.

Spiculæ one-flowered, without any exterior rudiment. Glumes nearly equal. "Stigmas sessile, or nearly so." *P. de B.* Inflorescence panicular, equal all round.

This tribe is rather formed to contain all the single-flowered Grasses which will not enter into any of the other tribes, than as uniting plants having a very distinct character of their own. They are all small plants, with a panicle of fine and almost capillary branches, and small flowers and seeds. The glumes are too large in proportion to suffer the student to search for the species among the *Oryzeæ*, except, indeed, in *Coleanthus*, where they are

totally wanting; but I have already stated in my observations on that tribe the reasons which induce me to place it here. The want of any trace of an exterior rudiment, as well as the more delicate texture of the paleæ, keep them away from the *Paniceæ* and *Phalarideæ*, and they have not those long silky hairs which distinguish the *Arundinaceæ*. The last character is, I must confess, the least satisfactory, for some species of *Agrostis* have soft hairs and not very short ones, so that without the smaller size and more delicate texture of the plant one might be at a loss in which tribe to place it.

Genera:

1. *Polypogon*. Glumes scariose, furnished with a long seta! Paleæ nearly equal, filmy, included. Awn dorsal, or none.
2. *Milium*. Glumes herbaceo-scariose, hardly exceeding the membrano-coriaceous paleæ. Paleæ nearly equal, unarmed, hardening on the seed!
3. *Agrostis*. Glumes membranous, acute. Paleæ smooth, scariose, unequal in length, the inner sometimes wanting. The awn, if any, is dorsal.
4. *Vilfa*. Glumes unequal, falling short of the paleæ, both membranous. Paleæ nearly equal, unarmed.
5. *Coleanthus*. Glumes 0; flowers solitary; paleæ unequal; the outer with a rough keel, terminating in a short seta. Stamens 2!
6. *Knappia*. Inflorescence in a raceme, somewhat one-sided. Spiculæ truncate. Paleæ included, scariose or filmy, shaggy, the inner minute or wanting.

The awn is wanting in *Polypogon maritimum*; where it occurs it is easily separable from the corolla, and is therefore a true awn. The long terminal seta of the glume in this genus is very remarkable, separating it at once from almost all others. Smith and Hooker describe it as strictly terminal. To me it seems to be placed a little below the extremity.

Milium. *M. effusum* is the only European species left by Kunth in this genus, and he places it among the *Paniceæ*, considering the part which has the appearance of an inner glume, and which is quite similar in form and texture to the outer glume, as a neutral floret. There is nothing in the structure or disposition of the parts to countenance such an hypothesis, and I therefore consider it as belonging to the *Agrostideæ*. Vilfa of Link offers only one

European species, which is united by Kunth to *Sporobolus*, but it wants the *soluble pericarp* so remarkable in that genus. There is some difference of appearance between this plant and *Agrostis*, to which, however, it perhaps might be reunited without impropriety.

Of Agrostis Palisot de Beauvois makes 5 genera. *Agraulos*, palea only 1, awned. *Trichodium*, palea 1, unarmed. *Agrostis*, paleæ 2, the outer one awned. *Vilfa*, paleæ 2, unarmed; and *Apera* (*Agrostis spica venti*), which is separated on account of the almost terminal position of the awn.

Sir J. E. Smith says that the corolla in this genus is usually larger than the calyx. In all the species which I have had the opportunity of examining, except in *A. spica venti* and *A. interrupta*, forming the genus *Apera* of Palisot de Beauvois, the corolla is decidedly smaller than the glumes. Kunth says, "glumæ florem plerumque multo superantes," and the figures of Palisot de Beauvois and of Reichenbach agree in representing the corolla as smaller than the calyx.

Coleanthus is a delicate little Grass, of which we know only one species, and this seems to be confined to Bohemia. It cannot be confounded with any other, nor, I think, joined to any other tribe.

Kunth places Knappia among the *Phalarideæ*; of course it would in that case belong to the division of the tribe which I have separated under the name of *Phleineæ*; but on the whole, I have preferred numbering it among the *Agrostideæ* in spite of the peculiarity of its inflorescence,—a peculiarity which has induced Sir W. Hooker to place it among the spiked Grasses. The palea is very thin and tender, truncate and lacerate at the top, and covered with a sort of shagginess, which seems rather to consist of torn-up portions of its substance than of hairs. These circumstances render it very difficult to tell whether or not there is an inner palea, as it is not easy to exhibit the outer without tearing it, and impossible to decide from its appearance when displayed whether it has been torn or not.

I have been very much at a loss to know by what name this Grass ought to be called. Adanson, who first separated it from *Agrostis*, called it *Mibora*; "but," says Sir J. E. Smith, "that author's names, so often founded on bad principle, have been generally neglected." The next name was *Chamagrostis*; and surely if *Mibora* was founded on a bad principle, this rests upon a worse,

inasmuch as a name without any meaning must be less objectionable than one with a false meaning. Hoppe in 1799, according to Gaudin, gave to it the name of *Sturmia,* and Smith in English Botany, in 1803, that of *Knappia.* The proper name would, therefore, undoubtedly be *Sturmia,* if this had not been already given by Gærtner to a species of *Guettarda,* of which, whether it really deserve to constitute a genus or not I cannot tell. In this uncertainty I leave it for the present under the name by which it is best known to English botanists; at the same time, I cannot but think that Sir J. E. Smith acted not wisely in altering the specific name. *Minima* merely implies that it is a very small Grass, and by no means necessarily that it is the smallest of the genus; and *agrostidea* is quite as objectionable, as it would be easy to conceive a Grass much more like an *Agrostis* without losing the generic distinction of *Knappia.*

Stipaceæ.

Spiculæ in an equal panicle, one-flowered, without any rudiment either above or below. Glumes herbaceous at the base, scariose at the margin, including the floret. The principal character is in the outer palea, which is convolute, and hardens on the seed without being attached to it. The extremity thus rolled up forms the base of an awn, which is connected by a more or less evident joining* at the base, and is in most instances geniculate and twisted. This character alone seems in all cases to carry the habit along with it, and to fix the plant among the *Stipaceæ.* Squamulæ 3.

1. *Piptatherum.* Floret sessile. Paleæ subcoriaceous. Awn straight, deciduous. Panicle lax.
2. *Stipa.* Floret stalked. Paleæ coriaceous, the inner entire. Awn with an evident joining into the paleæ, geniculate and twisted. (In *S. aristella* the floret is sessile, and the awn straight and even).
3. *Achnatherum.* Glumes scariose, herbaceous at the base. Floret stalked, enveloped in silky hairs. Paleæ membranous. Awn geniculate and twisted, the joining obscurely marked.

* I use *joint* for the thing joined; *joining,* for the point of union. The arm is a joint; the elbow a joining. This language appears to me more correct, and more convenient in botanical descriptions, than the usual confusion between the two terms.

Piptatherum is a genus of 4 or perhaps 5 species, all European, which were separated by Palisot de Beauvois from *Agrostis* and *Milium*. Kunth says of the spiculæ of Piptatherum, "basi haud articulatæ." I am ignorant of the precise import of this phrase. None of the *Stipaceæ* are described as having the spiculæ articulate at the base. Such a character might well be given to a plant, for instance, like *Imperata cylindrica,* where the whole spicula, glumes included, readily separates from the callus which supports it. In *Melica* also the calyx appears to fall off; but in most Grasses the separation of the floret takes place within the glumes, and this seems to be the case with all the *Stipaceæ*. In *S. aristella* the floret is sessile, and the awn neither geniculate nor twisted; perhaps it ought to form a distinct genus, or be united to *Piptatherum*. In the *Mantissa* it is called an *Agrostis*. In all the other species the awn is geniculate and generally with two knees, which, however, are not very acutely bent. The part between the knees is less closely twisted than the lower part of the awn, but in the same direction. Two broad ribs run down the awn, and each side of each rib is furnished with a row of hairs, which in some species are short and bristle-like, in others soft and long, or bristly in the twisted part, and longer and finer in that which is not twisted. Duby in the *Bot. Gall.* describes *S. capillata* "aristis basi rectis apice tortilibus;" but this is certainly erroneous. I have preferred the name of Achnatherum given by Palisot de Beauvois to the inadmissible compound *Lasiagrostis* adopted from Link by Kunth. It is true that some species were included by the first-mentioned writer, which succeeding botanists do not acknowledge; but as these are sunk in other genera, they form no objection to the appropriation of the name to this. In habit the European, and probably the Siberian species approach to *Arundo*.

Arundinaceæ.

This tribe, like the following, contains some plants of which the spiculæ are one-flowered, and others in which they are many-flowered, but with so much similarity of habit and structure, that Linnæus united them all into one genus. I follow other botanists in finding the technical difference in the long silky hairs which envelope the florets, but I confess it to be a nice point to distinguish the tribe on this ground. Some species of *Agrostis*, as has been already observed, are not entirely destitute of such hairs, and nearly if not

quite as long as those in *A. Halleri* or *A. sylvatica*. The size and coarseness of the plant common to the tribe forms certainly part of our notion of the *Arundinaceæ*, but *A. tenella* seems intermediate both in this circumstance and in the hairs which envelop its florets, and it is placed by some botanists in the genus *Agrostis*. On the other hand, some of the many-flowered species seem technically to approach to *Avena*; but the hairs of the latter genus are usually stiffer, and not so fine and silky as in *Arundo*. The awn too, when it occurs, is always stronger among the *Avenaceæ*, and twisted as well as geniculate. If *Deschampsia cæspitosa* be rightly separated from *Aira*, its size and coarse perennial herbage, as well as the hairs at the base of the floret, might almost justify us in placing it among the *Arundinaceæ*.

In forming the genera of this tribe, the number of florets in a spicula seems hardly to afford a sufficient ground. The difference of habit between the two extremes is not great, and the gradation is complete from the strictly single-flowered spiculæ of *Calamagrostis*, to those containing also an abortive rudiment in *Deyeuxia*, and thence through *A. Plinii*, in which they have sometimes only a rudiment, and sometimes a complete second floret (when it becomes the *Arundo biflora* of the Florentine botanists), and *A. mauritanica* (which is perhaps the same species, but is described as having from one to three florets,) to *A. Donax*, where the florets vary from two to five. The gradation of habit is as complete as that of the number of florets. *Phragmites* loves a more watery situation than the others, and the barren or neutral lower floret affords us a good and stable generic character; but if I were to separate the many-flowered species, I should be disposed to unite *Calamagrostis* and *Deyeuxia* under the name of *Arundo*, as was done by Mertens and Koch, and to assign to the remaining plants the generic name of *Donax*. The genera I am willing to acknowledge are:

1. *Arundo*. Spiculæ 1- or more-flowered, the lowermost perfect. Glumes equal, or the outer the largest. These and the paleæ membranous. Panicle diffuse. Seed hairless.
2. *Ammophila*. Spiculæ 1-flowered, with an interior rudiment. Glumes nearly equal, membrano-scariose. Paleæ membranous, nerved, with a short, straight, nearly terminal awn. Panicle spike-like!

3. *Phragmites.* Spiculæ many-flowered, the lowermost imperfect and not covered with hairs. Glumes membranous, the outer much the smallest. Paleæ scariose, unarmed. Panicle diffuse.
4. *Ampelodesmus.* Spiculæ many-flowered, the lowermost perfect, *unless when the inner glume is changed into an imperfect floret.* Glumes not opposite, the outer rather the smallest, membrano-scariose. Paleæ membranous. Awn subterminal. Seed crested. Panicle diffuse.

It would appear from the above descriptions that the paleæ in Ammophila and Ampelodesmus are firmer than the glumes. In *Phragmites* the glumes are the firmest; in Arundo they are about of equal consistency, or the paleæ are the firmest. *Arundo* is variously awned: the awn is said to be sometimes wanting in *A. tenella*; *A. Donax* has no awn, but a distinct seta continued from the midrib between the two subulate points of the outer palea. In *A. Plinii* and *A. mauritanica* the outer palea gradually tapers into a long point. Phragmites has no awn.

Palisot de Beauvois has drawn three stigmas to Ammophila, but this must be a mistake; and he has some confusion in his account of *Donax* which I cannot unravel, the plates not agreeing with the letter-press.

Chlorideæ.

The European genera of this tribe are few, and are easily known by their inflorescence, the spiculæ being placed in two rows on one side of a flattened rachis, without any tendency to form an imperfect exterior floret. There is sometimes only one floret, with an interior, stalk-like rudiment, and sometimes more than one perfect floret. Kunth adds, that the superior is the exterior glume; but if I understand him aright, there are few Grasses in which it can be determined, where this is not the case. This I have already stated in the preliminary observations. I may add, that in the *Chlorideæ* the glumes and paleæ are nearly of equal consistency, or the latter rather the thinnest, and that, in the European species at least, though there is in some instances something of a point formed by the continuation of the midrib, there is no awn. The genera are:

1. *Cynodon.* Spikes fingered. Spiculæ 1-flowered, with an interior rudiment.

Glumes nearly equal, membranous. Paleæ of equal length, membranous, the outer much the broadest, and embracing the other.

2. *Dactyloctenium.* Spikes fingered; spiculæ many-flowered: inner glume mucronate. Paleæ unequal, the outer ventricose, membranous; the inner scariose.
3. *Leptochloa.* Spikes in a raceme. Spiculæ 2- or many-flowered. Glumes keeled. Outer palea keeled, 3-nerved. Awn straight.
4. *Beckmannia.* Spikes in a raceme; spiculæ 1—3-flowered. Glumes equal, deeply navicular, quite obtuse, and enlarging towards the apex. Paleæ membranous, less firm than the glume, awnless.
5. *Spartina.* Spikes upright, in a raceme. Glumes very unequal, the inner large, acuminate, and almost including the solitary floret. Paleæ unarmed, membranous, but less firm than the glume, the outer retuse. Styles united.

The single floret seems to be the principal distinction between Cynodon and *Chloris.* There is no European species of this latter genus. Dactyloctenium *ægyptiacum,* Willd., the only species with which I have any concern, was considered by Linnæus as a *Cynosurus*; and, in fact, these two genera may be taken as the connecting links which unite the *Chlorideæ* and *Festucaceæ.* Michaux ranked it as *Chloris,* to which its fingered spikes give it a considerable resemblance. It is said by Steudel to be the *Cenchrus ægyptius* of Linnæus. Lamarck placed it with *Eleusine.* Walter (Carolin.) with *Ægilops.* At last Willdenow established for this and one or two more species a new genus with a bad name, which I have not presumed to alter. Beckmannia is inserted by Kunth among the *Phalarideæ,* but it has no trace of an external imperfect floret, and the structure of the flower, as well as the one-sided spikes, point out its strong affinity with *Chloris.* Spartina is the only genus whose position is doubtful, yet the description approaches nearly to that of *Cynodon.*

Avenaceæ.

The necessary insertion of the *Arundinaceæ* and *Chlorideæ* has somewhat interrupted the natural series which might pass from *Stipa* to *Avena.* All the genera have glumes, which are scariose on the margin (except in *Gaudinia*),

and as long, or nearly as long as the spicula, and this contains, except in *Lagurus* and in *Arrhenatherum*, two or more perfect florets. With the exception of the latter genus, the tendency of this tribe is to perfect its lower florets, while the upper ones are frequently imperfect and tabescent. The paleæ are unequal in substance, the outer being much the firmest, frequently strongly ribbed, and generally with a scariose margin or extremity. The inner is altogether scariose, except on the two keeled nerves, permanent, and embracing the seed. A jointed and twisted awn rises from the back of the outer palea, but this is sometimes wanting. The inflorescence is in a panicle, spreading all round, except in *Gaudinia*, where it is in a spike, the spiculæ being in opposite rows on a fragile, alternately channelled rachis. The inequality of substance in the paleæ, and the greater firmness of the outer, as compared to the glumes, may be added to the marks already pointed out, which distinguish these plants from the *Arundinaceæ*. They are separated from the *Festucaceæ* chiefly by the nature of the awn, by the stiff hairs at the base of the floret, and by the greater comparative length of the glumes. Unfortunately, the stiff hairs at the base of the floret do not always exist; nor is the dorsal, geniculate awn always present. The awn or seta among the *Festucaceæ* is never geniculate, although it is somewhat curved and twisted in some species of *Bromus*; but the awn in the *Avenaceæ* arises from the substance of the paleæ, and never from the union of several nerves as in that genus, while in the other genera of *Festucaceæ* it is evidently a mere continuation of the midrib.

The genera are:

1. *Aira.* Glumes 2-flowered, without any rudiment. Outer palea nerveless, included. Awn, if any, dorsal, geniculate.
2. *Deschampsia.* Glumes keeled, containing (but not including) 2 perfect florets, and the rudiment of a third more or less developed. Awn dorsal, straight.
3. *Lagurus.* Glumes 1-flowered, scariose, ending in a long fringed seta! Outer palea nerved, ending in two long setæ and an intermediate geniculate and twisted dorsal awn.
4. *Trisetum.* Glumes 2—6-flowered, membranous, not exceeding the florets. Outer palea scariose, without nerves or any distinct keel, ending in two

acute teeth, with an intermediate slender geniculate and twisted dorsal awn. Seed without a furrow and without a crest.

5. *Avena.* Glumes nearly equal, 2 or more flowered, herbaceous, with a scariose margin. Outer palea scariose, nerved, ending in two points, with an intermediate geniculate and twisted dorsal awn. Seed furrowed, and hairy or crested, elliptic-oblong, attached to the inner palea.
6. *Gaudinia.* Spiculæ many-flowered, in two opposite rows on an alternately channelled brittle rachis. Glumes very unequal, the longest (superior) much shorter than the spicula.
7. *Arrhenatherum.* Glumes 2-flowered, the lower barren, with a geniculate and twisted dorsal awn. Awn of the fertile floret short and straight. Paleæ scariose, the outer ribbed and ending in two points.
8. *Holcus.* Glumes 2-flowered, the lower perfect, awnless; the upper barren or perfect, with a dorsal awn. Paleæ without ribs, hardening on the seed.
9. *Danthonia.* Glumes 2—3-flowered, membranous, as long as the spicula. Outer palea quite smooth and coriaceous below, rounded at the back, bifid, with a firm, broad, intermediate point, which sometimes becomes the base of a geniculate awn.

The difference of habit seems to justify the separation of *Deschampsia* from *Aira.* It has usually the more or less perfect indication of a third floret, which is wanting in the latter genus. The straight awn also rising from near the base is never wanting, and such an awn is found in no species of *Aira.* I am more inclined to rest upon this character than upon the 4 teeth of the paleæ, which, it seems to me, are not cut with such precision as to give much confidence in their always occurring in the same number; and similar teeth are not unfrequent in *Aira flexuosa.* Indeed I find hardly any Grass where this part has the firmness and regularity exhibited in the figures of Palisot de Beauvois. I unite *Corynephorus* and *Airopsis* to the remaining species of Aira. The first has a distinct and beautiful character in its clubbed awn and the little tuft of hairs at the genicula, but the habit is that of some species of *Aira. Airopsis* has been separated on its want of an awn, and on the three lobes or teeth which terminate the inner palea. Yet Kunth says, "obsolete triloba," which does not indicate a clear distinction. What he considers as *genuine* species

are only 2, not much alike in general appearance, *A. globosa* and *A. agrostidea*, and of these he calls the first "species anomala," and doubts if it do not rather belong to *Aira*: yet this is, I believe, the original species. In *A. globosa* the outer palea is rather firmer than the glume; in *A. agrostidea* the paleæ are the thinnest and most pellucid. *A. agrostidea* has perfectly smooth paleæ, contrary to the generic character of *Airopsis*. In most of the *Airæ* the seed seems to be loose and the corolla unchanged; but in *A. caryophyllea*, *præcox*, *capillaris*, *pulchella*, and probably some others, the paleæ harden upon the seed. These are very different in habit from *A. flexuosa*, and I have doubted whether it might not serve as a foundation for remodelling the genera, but I have not materials for following out the investigation. The outer palea is without any prominent nerve or rib in the hitherto acknowledged species; but I have a small Grass from the neighbourhood of Rome, which in many respects is an *Aira*, and with the habit of *Aira caryophyllea*, where the outer palea is strongly ribbed, much firmer than the glume, and fully as long, but it does not harden on the seed. I propose to call it *Aira costata; paleâ inferiore costatâ glumis firmiore immutatâ.*

The single flowers of Lagurus separate it from the rest of the tribe, and the compact head might lead the student to place it among the *Phleineæ*, but an examination of the florets will certainly induce him to seek for it here.

Of Trisetum Kunth says, "Differt ab *Aira* non nisi numero florum;" but *T. phleoides*, *T. molle*, *T. toluccense*, *T. elongatum*, *T. condensatum*, *T. læflingianum*, *T. Cavanillesii* are described by himself as having only two flowers. Why do they not belong to *Aira*? I am more disposed to rest the difference on the comparative length of the glumes, which in most species of *Aira* considerably exceed the spicula. Yet this is not the case in *A. flexuosa*, which perhaps might be joined to *Trisetum*. In habit the difference is more marked, yet it is difficult to say precisely in what it consists. The panicle is more dense in *Trisetum* than in most of the *Airæ*, yet, perhaps, not more than in *Aira præcox*, which nobody thinks of uniting with *Trisetum*; perhaps we may say that it chiefly depends on the crowded spiculæ of the latter genus, while those of *Aira* are very much scattered. To distinguish *Trisetum* from *Avena*, we must, I think, depend chiefly on the seed, which in the former genus has neither crest nor furrow.

The spiculæ of Avena are said to be 3 or more flowered, but we cannot depend on this character, since *A. sativa* and *A. orientalis* have only 2; and this is sometimes the case with *A. fatua*, *A. hirtula*, *A. amethystina*, *A. brevis*, and *A. alba*, among the Grasses of Europe: we must, therefore, chiefly rely upon the furrowed and crested seed to distinguish it from *Aira* as well as from *Trisetum*. The awn is said to be from the base of the palea in *Aira*, and from the back in *Avena*, and the former has a shining panicle, but there are exceptions both ways to each of these circumstances.

Gaudinia is readily distinguished by its spiked florets and unequal glumes, and I think there is no danger of its being referred to any other tribe. The geniculate dorsal awn is not to be found among the *Hordeaceæ* or *Rottboelliaceæ*.

Arrhenatherum and Holcus are sufficiently marked by the characters above given. The habit of the plant obliges me to place here the first of these genera in spite of the outer imperfect floret. It cannot be confounded with any of the *Paniceæ* or *Phalarideæ*. The membranous and strongly-ribbed paleæ and geniculate dorsal awn keep it quite distinct from these families. Danthonia *decumbens* has been considered as a *Poa* and as a *Festuca*, and it might seem, therefore, probably to belong to the *Festucaceæ*, but I think Kunth has done well in placing it here. I am in this principally guided by the large membranous glumes, and by its close affinity to *D. provincialis*, from which it differs almost in nothing but in the want of the twisted upper part of the awn. Without pretending to decide whether *Triodia*, of which I know nothing, be really a distinct genus, I cannot agree with those who would separate these two species.

Festucaceæ.

This is on the whole a very distinct tribe, although closely allied by some of its genera to the *Avenaceæ* on the one hand, and to the *Hordeaceæ* on the other. The spiculæ are scattered, many-flowered. The glumes are unequal, shorter than the spicula, generally thinner than the outer palea, never of a thicker or firmer substance. The outer palea is usually more or less distinctly nerved or ribbed, herbaceous or membranous, not coriaceous while the plant is in flower, but in some species hardening on the seed; while in others the inner becomes attached to the seed without alteration. They generally have

a scariose margin, and are sometimes furnished with a point or seta, never with a separable awn. The inner palea is scariose and pellucid, except on the two nerves or keels, which are green, and at which the palea is uniformly folded. The panicle is one-sided in *Melica, Sclerochloa, Dactylis,* and *Festuca*; in *Glyceria fluitans,* and in *Cynosurus echinatus, elegans,* and *aureus.* *Oreochloa* and *Cynosurus cristatus* have a one-sided spike. The rest have a panicle equal all round. The particulars, some or other of which distinguish them from the *Avenaceæ,* are the small glumes, quite unequal to give any important protection to the spiculæ, and, as already noticed, the awn and the firm hairs at the base of the florets in that tribe, where they exist. This tendency to the production of one kind of arms or pubescence rather than of another, while the plant is often without either, can only with great difficulty be admitted into an artificial character; yet, I think, even there some use of it may be made, and in tracing natural affinities no botanist will deny its importance. *Schismus* and *Melica* have large glumes, and so in some degree has *Sesleria.* None of the *Festucaceæ* have long silky hairs like those of the *Arundinaceæ,* and none of them have the spicula in a simple spike with opposite rows; and this constitutes their leading difference from the *Hordeaceæ.* It is true that *Triticum Nardus,* and *T. unilaterale* have their flowers in one-sided spikes, which may render it doubtful whether they should not be placed among the *Festucaceæ,* but not whether any of the *Festucaceæ* should be joined to that tribe. *Festuca maritima* and *F. divaricata,* two plants certainly of the same genus, and which with Kunth I refer to *Festuca,* have their spiculæ sessile on a channelled and toothed rachis. But the rachis is branched and triangular, the spiculæ occupying only two faces of the prism, making the whole inflorescence one-sided, and giving to each plant quite the air of a *Festuca.* *Triticum loliaceum* (*Sclerochloa loliacea*) has also a one-sided disposition throughout, and the spiculæ are not quite sessile. The genera are:

1. *Kœleria.* Spiculæ crowded, compressed; glumes nerved, membranous; inner nearly as long as the spicula. Florets 2—5, crowded. Outer palea keeled, nerved (not ribbed), acuminate, or with a straight terminal or subapicular seta.

2. *Schismus.* Glumes ribbed, obtuse, much larger than the paleæ! and nearly

inclosing the spicula, scariose at the margin. Outer palea of the form and construction of the glumes. Florets distant.

3. *Melica.* Glumes nearly equal, membranous, with a scariose margin, as long as the ovate compressed spicula. Florets 1 or 2, with the additional stalked, club-like rudiment of one or two more. Paleæ many-ribbed, hardening on the loose seed.

4. *Molinia.* Glumes much shorter than the lanceolate spiculæ. Florets 2 or 3, with the subulate rudiment of 1 more. Paleæ hardening on the loose seed.

5. *Catabrosa.* Glumes rounded, or truncate and erose, shorter than the spicula. Florets 1 or 2, the upper on a long stalk, without any additional rudiment. Outer palea membranous, with 3 ribs ending in as many teeth, which are united by the scariose margin.

6. *Sesleria.* Spiculæ sessile, tiled all round. Glumes membrano-scariose, very acute, nearly or quite as long as the spicula. Outer palea keeled, membranous, with a scariose margin ending in 3 or 5 points. Spike compact, with bracteæ or abortive glumes at the base. Styles long, united below. Stigmas very long. Squamulæ laciniate.

7. *Oreochloa.* Spiculæ compressed in two rows, forming a 1-sided spike or head. Outer palea concave, entire, mucronulate. Styles long, united.

8. *Poa.* Glumes nearly equal, shorter than the spicula. Outer palea membranous below, scariose at the tip, the parts usually separated by a purple stain, nerved, subacute, compressed, keeled, unarmed. Panicle scattered, equal.

9. *Eragrostis.* Glumes and outer palea similar, membrano-scariose, equal throughout, with 3 prominent converging nerves. Spiculæ oblong or linear, 6—20-flowered, unarmed. Panicle scattered, equal.

10. *Glyceria.* Glumes unequal, acute, membrano-scariose. Florets numerous, cylindrical. Outer palea obtuse, or somewhat truncate, with 5 or 7 prominent nerves ending in long teeth, which are united by the scariose margin, unarmed.

11. *Sclerochloa.* Glumes unequal, acute, membranous. Outer palea cylindrical at the base, with rounded, obscurely marked ribs upwards, often keeled towards the top, truncate or obtuse, unarmed.

12. *Briza.* Glumes nearly equal, broad, boat-shaped. Outer palea navicular, heart-shaped, ventricose, keelless, obtuse, unarmed. Glumes and paleæ membranous with a scariose margin. Seed obovate, free.

13. *Cynosurus.* Spiculæ attached to a neutral spike or spicula of many glumes! Fertile spicula 1- or more-flowered. Glumes scariose, with a strong membranous keel. Outer palea membranous, with a terminal seta. Panicle or spike one-sided.

14. *Dactylis.* Glumes many-flowered; outer keeled, herbaceo-membranous, taper-pointed; inner smaller, scariose. Outer palea keeled, with a terminal seta. Spiculæ crowded. Panicle one-sided.

15. *Festuca.* Glumes thinner than outer palea, which is very acute, or furnished with a point or seta, at, or very close to, the extremity. Spiculæ subcylindrical, scattered. Panicle one-sided.

16. *Bromus.* Outer palea like the glumes, herbaceous, with a scariose margin, subcylindrical, ribbed, with a seta founded on 3 nerves from below the tip. Panicle equal all round. Seed linear, convex, crested, attached to the inner palea.

It is very difficult to establish good generic characters among the *Festucaceæ*. Kœleria appears to me to form a natural group, of which some of the species are armed and some are not, and there does not want a slight difference of habit between these two divisions. The first form the genus *Airochloa* of Link, of which *K. cristata* may be taken as the type. The second trenches very closely upon *Trisetum*. The species of this genus have been ranked with *Aira*, *Festuca*, *Phalaris*, *Alopecurus*, *Holcus*, *Trisetum*, *Bromus*, *Dactylis*, and *Cynosurus*. *Kœleria macilenta*, with its very unequal glumes, is perhaps nearly allied to *Festuca Myurus*, and I endeavour in vain to trace in the characters given by Kunth, any difference between these genera, unless, indeed, it be in the seed, which, according to him, is free in this genus, and attached in *Festuca* to the inner palea. Sir J. E. Smith will not allow this character in *Festuca*, and it certainly does not exist in all the species. The crowded and shortened spiculæ of *Kœleria* are the circumstances which first strike the eye, and on these and on the compressed and keeled florets we must rely for the distinction. From *Trisetum* it differs in the arm, which is an awn in that

genus, with a tendency to become geniculate and twisted, and rises from about the middle of the back of the bicuspidate palea. In this it is a seta from near the extremity of the entire palea. This, in words, seems amply sufficient; but on examining the species, each of the characters is sometimes so slightly marked, that the student is at a loss to know to which genus a plant may belong.

The large glumes of Schismus might induce us to put it with the *Avenaceæ*. The florets, cylindrical and truncate, and bluntly ribbed towards the extremity, bring it near to *Sclerochloa*. Linnæus considered it as a *Festuca*, and De Candolle placed it with *Kœleria*, with which it has very little affinity. Palisot de Beauvois marks a small terminal seta which I do not observe.

Melica, like *Schismus*, has large glumes, and neither awn nor seta. The one-sided inflorescence and linear seed favour its arrangement with the *Festucaceæ*, and its habit is very different from that of the *Avenaceæ*. Yet in this respect it divides itself into two parts, *M. ciliata* and *M. Bauhini* presenting a very different appearance from the wide-spreading branches of *M. aspera*, *M. minuta*, and *M. uniflora*. In *Melica ciliata* I usually find the second floret barren, and the third so small as to be exposed with difficulty. Both unite to form the club-like rudiment which characterizes the genus. *Melica persica* is said to have 6 florets, of which the lower alone is perfect. Molinia seems well divided from *Melica*. Whether *Festuca serotina* be rightly placed with it may admit of a doubt. It must mainly depend on whether the paleæ harden or not on the seeds.

Catabrosa is a very distinct genus, which has nothing in common with *Aira*, with which it was formerly united, but the number of its florets.

In Sesleria, the large and almost scariose glumes and the three or five nerves of the outer palea, each running beyond its scariose membrane into a short point, clearly mark the genus. We can hardly conceive this structure united to a true awn, and therefore have no hesitation in placing it among the *Festucaceæ*. None of the *Avenaceæ* have a clearly marked point or seta continuing from the inner nerve of the outer palea. The united styles and long stigmas are probably important; yet Kunth says, "styli duo, breves." *Sesleria disticha*, or *Poa disticha*, as it has sometimes been called, wants both these characters, and agrees better with *Poa*, with which it has been united

by many botanists. It differs from both in its one-sided head of flowers, and I readily follow Link in making of it a distinct genus under the name of *Oreochloa*. *Sclerochloa dura* has nothing in common with *Sesleria* either in character or habit, nor can I understand what induced Linnæus to join it with *Cynosurus*. Its nearest affinity is that pointed out by Palisot de Beauvois with *Sclerochloa procumbens*, but this can by no means be separated from *S. maritima* and the other *Glyceriæ* of Smith. Sclerochloa thus formed is, I think, a natural genus, though it must be confessed that *S. dura* is very different from the more delicate species, and especially from the *Festuca expansa* of Kunth, which yet seems better placed in this than in any other admitted genus; but the dichotomous inflorescence, thickened flower-stalks, and connate glumes, might, if it had companions, make it the type of a separate one; Trinius accordingly has named it *Sphenopus*.

The purple stain noticed in *Poa* between the thicker part of the palea and its scariose transparent margin occurs also in *Sclerochloa*, and in some species of *Festuca* and of *Avena*. I suspect it to have something to do with the structure of the parts, though I cannot point out the relation.

I place with *Sclerochloa* two plants, not generally admitted into the genus, *Poa rigida* and *Triticum loliaceum*. In the former, the outer palea is totally without ribs and terminates in a small mucro, but its habit and one-sided panicle agree very well with that of the genus. The latter absolutely differs in nothing from the rest but in its nearly sessile florets; and the branched rachis and one-sided spiculæ keep it very distinct from *Triticum*. *Poa littoralis*, auct., is nearly allied in habit to *Sclerochloa*; but the acute form and decided mucro of the outer palea obliges me to join it to *Festuca*.

Glyceria was established by Brown on *Festuca fluitans* alone. Smith added several species from *Poa*. Kunth transferred these to *Festuca*, preserving from among them only *G. aquatica* in addition to the original species. The two plants differ considerably in habit, and the latter has a panicle equal all round, while in the former it is one-sided; yet the structure of the flowers is so similar that I cannot separate them.

Eragrostis. Every botanist easily distinguishes this by its habit from *Poa*. I think the nature of the outer palea, whose texture is equal throughout, while in *Poa* it is invariably firm at the base, and terminates in a scariose extremity,

will form a better generic character than the form of the spiculæ and the number of florets, both of which vary greatly in the different species, and even in the same.

I am not at all clear that Cynosurus ought not to be divided into three genera. *C. cristatus* seems to have but little relation to *C. echinatus* and *C. elegans*, and *C. aureus* (*Lamarckia aurea* of Mœnch and Kunth) differs considerably from both.

The habit of Dactylis seems to be very distinct, while its keeled paleæ separate it sufficiently from *Festuca* and their point from *Poa*. The crowded position of the spiculæ is also very characteristic. These characters unite to a considerable degree in *Poa littoralis*, which has been placed by Willdenow and Schrader in this genus. The keel, however, does not continue to the base of the floret, and the outer glume is smaller, and certainly not more firm than the inner. Kunth considers it as a *genuine*, but not a *legitimate Poa*; a distinction which I do not comprehend. The spiculæ are strictly sessile on opposite sides of an alternately flattened rachis, whose branches, however, combine into a dense one-sided spike.

Festuca is a genus comprehending two or three different appearances, which are not easily united under one character, and which yet cannot well be separated. The first tribe, the *Mygalurus*, or *Vulpia* of Link, has the outer palea gradually tapering into a very long seta, and the glumes in general extremely unequal. The second, of which *Festuca ovina* may be considered as the type, has the glumes much more nearly equal, and the seta, where it exists, rising much more abruptly from the palea. This passes almost insensibly into those which have the point a little below the extremity of the palea, as *F. pratensis* and *F. elatior*; and there is another group approaching in appearance to *Poa*. Kunth has two more groups, one of which is my *Sclerochloa*, but also including *F. divaricata* and *Triticum maritimum*, two plants which I leave with *Festuca*. Gaudin makes a division of those *Festucas* which have a point not quite at the apex of the glume; but in *F. pratensis*, which may be considered as the type of the division, the awn sometimes adheres to the palea quite to its extremity.

The awn or seta in Bromus is not in general a mere continuation of the midrib, but is strengthened by the union of two lateral ribs, which usually

do not descend to the base of the palea. It is perhaps this structure which has induced Palisot de Beauvois to consider it as an awn, but it is by no means fragile at the point of junction with the palea, and something of the sort may be traced in some species of *Festuca*.

Hordeaceæ.

These are united among themselves, and separated from others by the inflorescence, the spiculæ being many-flowered, sessile, or very nearly so, on opposite sides of a channelled and toothed rachis, each tooth being the receptacle of one or more spiculæ, which is received in the channel above. The exceptions are in *Hordeum* and some species of *Elymus*, where the spiculæ are only one-flowered, and in *Triticum Nardus* and *T. unilaterale*, where the spike is one-sided. I should not be very averse to joining these plants with *Festuca*, only that I cannot well separate them from *T. Poa* and *T. tenellum*. The latter has sometimes a branched spike, which, however, is not one-sided. The union of these two deviations from the type of the tribe, viz. of a branched rachis and one-sided inflorescence, has led me to place *Triticum maritimum* (auct.) and *Festuca divaricata*, as I have already mentioned, with *Festuca*. *Gaudinia fragilis* is, I think, the only plant among those which form the subject of this essay, which has the technical character of this tribe without belonging to it. The genera are:

1. *Brachypodium*. Spiculæ distant, solitary, on a short stalk. Glumes unequal, the inner much smaller than the adjacent palea. Outer palea ribbed, setigerous.
2. *Lolium*. Spiculæ placed edgewise on the rachis! Inferior glume very minute, or wanting, except in the terminal spicula.
3. *Triticum*. Spiculæ solitary. Glumes opposite, nearly equal, embracing the florets.
4. *Secale*. Spiculæ solitary. Glumes very narrow. Outer palea tapering into a long seta.
5. *Ægilops*. Glumes somewhat oblique. These and the outer palea similar, turgid, ending in several rigid setæ.
6. *Elymus*. Spiculæ 2 or 3 together; each of 2 or more perfect florets.

7. *Hordeum.* Spiculæ in threes, 1-flowered, with the stalk-like rudiment of a second floret towards the common rachis.

The species of BRACHYPODIUM have been alternately united with *Bromus* and *Festuca.* Kunth joins them to *Triticum*, and I confess I find more difficulty in drawing up a character which shall distinguish them from that genus than from either of the others. The spiculæ are not more stalked than they are in the division *Micropyrum*, nor perhaps than in *Triticum caninum*; and in *T. Nardus* the glumes are nearly as unequal as in *Brachypodium.*

"Spiculæ rachi contrariæ," "Calyx racheos scrobiculæ parallelus," "Spiculæ rachi parallelæ," are the terms used by different botanists to express the peculiar position of the spiculæ of LOLIUM. Smith's calyx of one valve opposite to the rachis is less obscure, but seems hardly sufficient to indicate the position of the spicula itself.

TRITICUM, as it stands now, is a difficult genus to characterise. Smith says, "Calyx of two transverse opposite valves, solitary, many-flowered:" this would certainly include *Brachypodium*, and was probably intended to comprehend *T. loliaceum* and *T. maritimum.* There is nothing also to exclude several other plants whose flowers are sessile on a one-sided or two-sided rachis. The word *transverse* is probably introduced to distinguish it from *Lolium*, but does not well explain the position of the spiculæ. In the longer description of the genus he says, "spikelets lateral, contrary to the main stalk." Kunth, on the other hand, says, "spiculæ rachi communi parallelæ." Smith adds, that the outer palea is keeled or furrowed; but this is not true of *T. durum*, nor can it be well said of *T. repens*, where neither keel nor furrow is carried down to the base, nor are there either keels or furrows to the division *Micropyrum.* He assigns to it a loose seed, but the seed is said to be attached in *T. Spelta*, *T. monococcum*, *T. dicoccum*, and I find it to be so also in *T. Poa.* In *T. Nardus* the valves are unequal; and without the character of equal valves, which obtains through most of the genus, we seem to have no distinction from *Brachypodium.* The habit would make me wish to keep distinct the four genera *Brachypodium*, *Agropyrum*, *Micropyrum*, and *Triticum*; but I have laboured in vain to find characters on which they might be divided. The seed is crested in the cultivated wheats, but not, I believe, in any species of the divisions *Agropyrum* and *Micropyrum.*

Secale seems better separated from *Triticum* on the small and inefficient glumes, and on the tapering form of the outer palea, than on the number of florets.

I have not before me a sufficient number of species to affix new limits to the genera Elymus and Hordeum, but I am inclined to find the distinction in the setaceo-aristate glumes, and perhaps in the long awns or setæ of the latter genus. The number of florets does not seem to afford a satisfactory line, since *E. europæus*, which is described as two-flowered, is certainly more commonly met with, as is observed by Sir W. Hooker, having only one, and indeed I have never found in the specimens I have examined two perfect florets. The rudiment of the second is usually a mere stalk, and the whole structure of the flower exactly like that of *Hordeum pratense*. *E. crinitus* has usually a distinct palea, perhaps two, to the second floret, but as far as I have seen, it is always empty. These two species, and probably two or three more, not natives of Europe, would on my scheme be joined to *Hordeum*; but I do not know how far it would be possible to draw a line throughout the genus in accordance with the habit of the plants.

Pappophoreæ.

This is a very small tribe, containing in the whole only 7 genera, and 28 species. In Europe we have only 1 species, which is particularly interesting, as it enables our Flora to yield an example of every tribe into which the Grasses have been divided. The leading characters seem to be the thin and entire glumes united to coriaceous and many pointed paleæ.

Echinaria. Spiculæ sessile, crowded, placed all round the rachis, 2—4-flowered, of which not more than the two lower are perfect. Glumes ending in a seta. Outer palea with five, inner with two points. Seed hairless.

Rottboelliaceæ.

These differ from the *Hordeaceæ* in having only one perfect floret placed edgewise on the spike, which is sometimes one-sided, sometimes equal all round. According to Kunth, the second imperfect floret, where it occurs, is in some genera above, and in some below the perfect one. Is this to be considered as an indication that he has united two tribes into one? or that

with regard to these characters, as to almost every other, we have here a tribe in which they vary? Perhaps we may find in some of the tropical genera of *Rottboelliaceæ* an approach to the *Paniceæ*, reducing the arrangement of the whole family to a circular order. I have only three genera to notice, containing in all but six species.

1. *Nardus.* Spiculæ in two rows, on one side of a continuous rachis. Glumes 0. Outer palea keeled, tapering into a subulate point. Stigma 1.
2. *Psilurus.* Spiculæ on opposite sides of the cylindrical but deeply channelled rachis. Glume 1, small. Outer palea membranous, awned; inner as long, scariose. Stamen 1.
3. *Lepturus.* Spiculæ imbedded in the channels of the cylindrical or prismatical fragile rachis. One-flowered, with an interior rudiment. Glumes 1 or 2, opposite to the rachis, and as long as the scariose paleæ.

Psilurus *nardioides* seems well separated from *Nardus*. Schrader put it with *Rottboellia*; Palisot de Beauvois called it *Monerma*. I take it for granted that *Psilurus*, the name given to it by Trinius, and adopted by Mertens and Koch, as well as by Kunth, is the most ancient. The spiculæ are placed somewhat obliquely, and the glume is not exactly opposite to the rachis, the abortive floret on one side appearing conspicuously from underneath it.

Lepturus contains the 4 European species which were formerly given to the genus *Rottboellia*. It has only one spicula at each joint of the rachis, and this contains one perfect, and a *superior* imperfect floret or rudiment. The true *Rottboellia* has 2 spiculæ at each joint, one of which is tabescent, and the perfect spicula has one perfect and an *inferior* imperfect floret or rudiment.

Before concluding this essay I will offer an artificial arrangement of the Grasses, founded chiefly on their inflorescence, which seems to yield the most distinct and definite characters, and is therefore best adapted to facilitate the researches of the student, and enable him to determine to what genus any plant under examination may belong. With the same object in view we may observe,

That the spikes are fingered in *Cynodon, Dactyloctenium, Digitaria*, and in some species of *Andropogon*.

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That the calyx is wanting in *Leersia, Lygeum, Coleanthus,* and *Nardus.*

That it is setigerous in *Sesleria, Phleum, Polypogon, Lappago, Lagurus, Hordeum, Ægilops,* and sometimes in *Triticum* and *Elymus.*

That *Psilurus,* and sometimes *Erianthus,* and according to some authors, *Festuca myurus, F. bromoides,* and *F. uniglumis* are *monandrous.*

That *Imperata, Erianthus* sometimes, *Anthoxanthum, Crypsis aculeata, Bromus diandrus, Coleanthus,* and the perfect flower of *Hierochloe,* are *diandrous.*

That *Nardus, Lygeum,* and *Echinaria* have only one stigma.

That the styles are united in *Sesleria, Spartina,* and some species of *Alopecurus.*

That *Oryza* has 6 stamens.

That *Andropogon, Sorghum, Lappago,* and *Hordeum* have some of their spiculæ barren, and therefore belong to the Linnean class *Monœcia,* or rather, perhaps, to *Polygamia.*

That *Zea* alone of all Grasses found or commonly cultivated in Europe has fertile flowers without anthers, and that these and the barren flowers are in different parts of the plant.

A. Barren and fertile inflorescence separate!

17. *Zea.* Barren spiculæ 2-flowered, in a terminal panicle. Fertile, in a dense spike, 1-flowered, with an exterior rudiment.

B. Perianthium hardening into a 2- or 3-seeded nut.

18. *Lygeum.* Glume 0. Spiculæ enveloped in silky hairs. Outer palea thick and firm; inner scariose.

C. Spiculæ in opposite rows on an alternately channelled rachis.

1. Spiculæ 2 or more flowered, all perfect.

68. *Brachypodium.* Glumes unequal, ribbed, much smaller than the outer palea. Spiculæ on short stalks.

67. *Lolium.* Spiculæ placed edgewise on the rachis! Lower glume very obscure, or wanting.

69. *Triticum.* Glumes nearly equal, opposite, broad, embracing the solitary

spicula. Paleæ terminating rather abruptly, and generally with a point or seta.

70. *Secale.* Glumes narrow. Palea gradually tapering into a long seta. Seed crested. Spiculæ solitary.

71. *Ægilops.* Glumes placed somewhat obliquely; these and the outer palea herbaceo-coriaceous, turgid, terminating in several stout setæ.

72. *Elymus.* Spiculæ two or three together, all fertile. Glumes on one side.

47. *Gaudinia.* Glumes unequal, much shorter than the spicula. Outer palea with a geniculate and twisted dorsal awn. Rachis brittle.

2. Spiculæ with only one perfect floret, all fertile, placed edgewise to the rachis, and when closed, imbedded in it so as to form a continued cylinder or prism.

77. *Lepturus.* Glumes 1 or 2 on the same side of the unarmed spiculæ, which contains 1 perfect floret with an interior rudiment.

76. *Psilurus.* Glume 1, small, scariose. Paleæ of equal length, the outer with a terminal seta. Stamen 1.

3. Spiculæ in threes, the lateral ones usually barren, none with more than one perfect floret.

73. *Hordeum.* Glumes setaceo-aristate, both on one side of the spicula. A superior rudiment to all the spiculæ, towards the rachis.

Elymus europæus. Sclerochloa Triticum, divaricata.

D. Spiculæ 1-flowered, with additional scales, the rudiments of one or more exterior florets.

N.B. In *Andropogon*, *Saccharum*, *Erianthus*, and *Imperata*, from the delicacy of the parts, it is often very difficult to distinguish the additional rudiment, but these may be known from all European Grasses, not included in the preceding section, by the spiculæ in twos or threes, of which one is sessile.

1. Spiculæ sessile and stalked, the latter barren.

5. *Sorghum.* Spiculæ oblong, or somewhat ovate. Glumes of the fertile floret coriaceous, without striæ. Seed large, roundish.

4. *Andropogon.* Spiculæ linear, lanceolate. Seeds nearly linear.
In the European species of this genus, except in A. Gryllus *and* A. Allionii, *the spiculæ are in fingered spikes.*

2. Spiculæ all fertile, in two rows, on one side of a flattened rachis.

6. *Digitaria.* Spikes fingered. Spiculæ unarmed.
7. *Oplismenus.* Spikes racemose, or panicled. Spiculæ naked. Glumes keeled, pointed, or setigerous.

3. Spiculæ all fertile, in a compound spike tiled all round.

8. *Setaria.* Spiculæ accompanied by setiform bracteæ.
9. *Pennisetum.* Inner bracteæ feathery.

4. Spiculæ all fertile, disposed in sets, one sessile, and one or two stalked, enveloped in long silky hairs.

1. *Saccharum.* Awnless. Squamulæ 2. Inner palea minute, or wanting. Panicle not spike-like.
3. *Erianthus.* Lower palea of the fertile floret awned. Squamulæ 2. Stamens 2 or 3. Panicle spreading.
2. *Imperata.* Awnless. Squamulæ 0. Panicle spike-like.

5. Spiculæ all fertile, scattered, not enveloped in hairs.

14. *Phalaris.* Additional scales short, unarmed. Glumes navicular, keeled, inclosing. Paleæ coriaceous.
15. *Anthoxanthum.* Additional scales large, inclosing the scariose paleæ, awned. Glumes inclosing.
10. *Panicum.* Additional scale large, glume-like, embracing the horny ribless paleæ. Glumes not inclosing.

E. Spiculæ 1 or more flowered, without additional external scales, sessile, or nearly so, in two rows on one side of a flattened rachis.

In this, and all the following divisions, all the spiculæ are perfect, except in *Lappago*, where the uppermost of each short spike are barren, or neuter and tabescent, and *Cynosurus*, where the barren spiculæ form a sort of involucrum.

37. *Cynodon.* Spiculæ 1-flowered, with an interior rudiment. Spikes fingered. Glumes unequal, membranous. Paleæ membranous.

38. *Dactyloctenium.* Spiculæ 2 or more flowered. Spikes fingered. Inner glume mucronate. Paleæ unequal, the outer ventricose, membranous, the inner scariose.

39. *Leptochloa.* Spiculæ 2 or more flowered. Spikes in a raceme. Glumes keeled. Outer palea keeled, 3-nerved. Awn straight.

40. *Beckmannia.* Spikes disposed in a raceme. Spiculæ unarmed, 1—2-flowered. Glumes equal, deeply navicular, enlarging towards the apex, very obtuse.

41. *Spartina.* Spikes disposed in a raceme. Spiculæ 1-flowered. Glumes very unequal, the inner acuminate.

57. *Oreochloa.* Spiculæ many-flowered, in a simple spike or head. Glumes and outer palea concave, membranous, with a scariose margin.

75. *Nardus.* Glume 0! Outer palea keeled, and ending in a subulate point. Style 1. Stigma 1. Spiculæ quite sessile. Spike simple.

Knappia minima. Triticum Nardus and *unilaterale. Festuca maritima* and *divaricata. Sclerochloa loliacea.*

F. Spiculæ sessile, in a head or spike tiled all round.

56. *Sesleria.* Outer palea membrano-scariose, ending in three or five soft flexible teeth. Stigmas long. Styles united below.

74. *Echinaria.* Outer palea herbaceo-coriaceous, ending in several long rigid setæ.

G. Spiculæ scattered, 1 or more flowered. The florets enveloped in long silky hairs.

33. *Arundo.* Glumes membranous, equal, or the outer largest. Paleæ membranous. Awn, if any, fine and slender. Panicle spreading.

34. *Ammophila.* Spiculæ 1-flowered, with an interior rudiment. Glumes nearly equal, membrano-scariose. Outer palea membranous, with a short strong point below the apex. Panicle spike-like.

35. *Phragmites.* Spiculæ many-flowered, the lowermost imperfect, and not enveloped in hairs! Glumes membranous, the outer much the smallest. Paleæ scariose, unarmed. Seed hairless.

36. *Ampelodesmus.* Spiculæ many-flowered, the lowermost perfect, unless when the inner glume is changed into an imperfect floret. Outer glume rather the smallest. Palea with a sub-apiculate awn. Seed crested! Panicle diffuse.

H. Spiculæ scattered, 1-flowered, without glumes.

12. *Leersia.* Paleæ ribbed, herbaceo-membranous, of equal length, nearly valvular; the outer boat-shaped, unarmed.
28. *Coleanthus.* Paleæ membrano-scariose. The outer twice as long as the inner, setigerous. Stamens 2.
Lygeum.

I. Spiculæ scattered, 1-flowered, in a spike-like panicle or head.

19. *Achnodon.* Spiculæ spindle-shaped. Glumes equal, boat-like, unarmed, including. Outer palea unarmed, embracing the inner, of equal length.
20. *Phleum.* Spiculæ oblong. Glumes nearly equal, setigerous, parallel on the keel, including 2 unarmed paleæ.
21. *Alopecurus.* Glumes equal, unarmed, generally united at the base! Palea 1, the margins in some species united below! Awn dorsal.
22. *Crypsis.* Head or spike included in most species in a common involucrum. Glumes membranous, unarmed. Paleæ membranous, unarmed, as long as the glumes.

C. aculeata has only 2 stamens. *C. alopecuroides* a naked spike.

23. *Gastridium.* Glumes ventricose at the base! including. Paleæ scariose.
44. *Lagurus.* Glumes scariose, ending in a long fringed seta. Outer palea quite smooth, ending in two setæ, and an intermediate geniculate and twisted dorsal awn.
11. *Lappago.* Outer glume scariose; inner coriaceous and prickly.
Polypogon monspeliense and *maritimum.*

K. Spiculæ 1-flowered, scattered, in a loose panicle.

13. *Oryza.* Glumes small, separate from the floret and from each other. Stamens 6.

27. *Vilfa.* Glumes membranous, unequal, not exceeding the paleæ. Paleæ membranous, unarmed.

26. *Agrostis.* Glumes membranous, including. Paleæ unequal, smooth, not hardening upon the seed. Awn, if any, fine, dorsal.

29. *Knappia.* Paleæ scariose, shaggy, truncate, the inner minute or wanting. Spiculæ in a raceme, obscurely 2-rowed. Rachis cylindrical.

24. *Polypogon.* Glume furnished with a long slender seta! scariose, including. Paleæ scariose; the outer with a dorsal awn.

25. *Milium.* Glumes herbaceo-scariose. Paleæ membrano-coriaceous, nearly equal, unarmed, hardening on the seed.

30. *Piptatherum.* Glumes membranous. Floret sessile. Paleæ subcoriaceous, joined to a straight terminal awn, hardening on the seed.

31. *Stipa.* Glumes scariose, herbaceous at the base. Floret stalked. Paleæ coriaceous, hardening on the seed, a geniculate and twisted dorsal awn joined to its extremity.

32. *Achnatherum.* Glumes scariose, herbaceous at the base. Paleæ membranous. Awn geniculate and twisted, with a distinct though slightly marked joining on to the outer palea, at which it readily breaks off.

L. Spiculæ in a loose panicle, with a second imperfect floret.

49. *Holcus.* Lower floret perfect, unarmed. Upper generally barren, awned.

48. *Arrhenatherum.* Lower floret barren, with a geniculate awn; upper perfect, with a short straight awn.

16. *Hierochloe.* Two outer florets barren; middle perfect, diandrous, all unarmed.

Melica uniflora.

M. Spiculæ scattered, with more than one perfect floret.

N.B. In these genera, *Aira, Deschampsia, Danthonia,* and *Avena* are mostly awned, the awn easily breaking away from the palea. They are never furnished with a seta forming a mere continuation of the midrib. In *Trisetum* and *Kœleria* it is rather difficult to decide whether we find an awn or a seta. In the first of these genera it has more the character of the first; in the second, of the latter. *Dactylis, Bromus,* and *Cynosurus* are setigerous; *Festuca* is often

so, and we sometimes observe a small mucro on the outer palea of *Sclerochloa*; the others are constantly unarmed.

1. Glumes nearly or quite as long as the spicula.

42. *Aira.* Glumes 2-flowered, without any rudiment. Awn, if any, dorsal, geniculate and twisted. The paleæ in some species harden on the seed, but without adhering to it.

43. *Deschampsia.* Glumes 2-flowered, with usually the not club-like rudiment of a third. Outer palea truncate, with a straight awn, from near the base; surrounded with soft hairs.

53. *Melica.* Glumes nearly equal, larger than the paleæ, 1- or 2-flowered, with the additional stalked, club-like rudiment of 1 or 2 more. Paleæ unarmed, membranous, hardening on the seed.

50. *Danthonia.* Glumes 2 or more flowered. Outer palea smooth and coriaceous below, membranous and nerved above, emarginate, with an intermediate broad tooth, sometimes terminated with a geniculate and twisted awn.

52. *Schismus.* Glumes many-flowered, much larger than the palea, membranous, ribbed, with a scariose margin. Outer palea similar, subtruncate. (According to Palisot de Beauvois, there is a terminal seta.)

51. *Kœleria.* Glumes and outer palea herbaceo-scariose; the latter entire, acute, or with a terminal or subapicular, not geniculate seta. Spiculæ ovate.

45. *Trisetum.* Glumes and outer paleæ keeled, membrano-scariose, without prominent nerves. The latter ending in two teeth, with a slender dorsal awn, which in most species is geniculate. Seed without furrow or crest.

46. *Avena.* Glumes herbaceous or membranous, with a scariose margin. Outer palea firmer than the glume, ribbed, ending in two points, with an intermediate geniculate and twisted dorsal awn, which however is sometimes wanting. Seed furrowed and crested.

2. Glumes decidedly falling short of the spicula.

58. *Poa.* Glumes nearly equal. Outer palea compressed, keeled, membranous, with a scariose margin, entire, somewhat acute, unarmed. Panicle equal.

59. *Eragrostis.* Glumes and outer palea similar, membrano-scariose throughout, with three prominent converging nerves.

61. *Glyceria.* Glumes and outer palea membrano-herbaceous, with sharply prominent nerves and a scariose margin. Florets subcylindrical, unarmed.

60. *Sclerochloa.* Glumes and outer paleæ membranous, with rounded ribs, often obscure, which disappear towards the base. Florets cylindrical towards the base, keeled in some species at the tip, unarmed, or with a minute and hardly distinguishable mucro.

55. *Catabrosa.* Glumes and outer palea membranous at the base, both eroso-truncate; the latter with 3 ribs ending in as many teeth, which are united by the scariose margin.

62. *Briza.* Glumes nearly equal, broad, boat-shaped, obtuse. Outer palea navicular, heart-shaped, ventricose, keelless, unarmed.

54. *Molinia.* Glumes 2—3-flowered, with a subulate rudiment. Paleæ acute, both entire, membranous, firmer than the glume, and hardening on the seed.

63. *Cynosurus.* Spiculæ attached to a neutral spicula or spike. Fertile spiculæ 1 or more flowered. Glumes scariose, keeled. Outer palea concave, keeled, with a terminal seta.

64. *Dactylis.* Glumes unequal, many-flowered, acute, herbaceous. Outer palea herbaceous, with a terminal seta, compressed and keeled. Spiculæ crowded. Panicle one-sided.

65. *Festuca.* Glumes unequal, many-flowered, thinner than the palea. Paleæ ribbed, rounded on the back, very acute, or with a terminal or very nearly terminal seta.

66. *Bromus.* Glumes unequal, many-flowered. Palea ribbed, with a dorsal seta.

II. *On the Ovulum of* Santalum album. *By* William Griffith, *Esq., Assistant Surgeon in the Madras Medical Service. Communicated by* Richard Horsman Solly, *Esq., F.R.S. & L.S.*

Read April 5th, 1836.

THE following observations were made at the Botanic Garden, Calcutta, in the early part of July, 1835.

The ovarium as well as the fruit of this genus corresponds with the structure laid down by Mr. Brown as one of the principal distinguishing marks of *Santalaceæ*, of which order I presume this genus is the type.

I allude to the central free placenta, bearing towards its apex a definite number of pendulous ovula. Yet Roxburgh has mistaken the structure entirely, and has evidently described the placenta together with the ovula, which he did not see, for the *ovulum*. This author, in his *Flora Indica*, vol. i. p. 443, describes the ovulum as "Germ. semi-superum, one-celled, containing one conical seed attached to the bottom of the cell." This mistake is perpetuated in the Botanical Magazine, new series, t. 3235, in which Roxburgh's description is quoted, and said to be faithful. The error of Jussieu with regard to the *ovulum* of *Santalaceæ*, first pointed out by Mr. Brown in his *Prodromus Floræ Novæ Hollandiæ*, and subsequently in the Appendix to Captain Tuckey's Expedition to Congo, p. 453, might have partly originated from an examination of *Santalum*, in which the ovula from their situation and direction may very easily be overlooked.

The placenta in this species is conical, rather obtuse in the young flowers, but prolonged considerably in those that are matured. Its apex corresponds at this period to the termination of the canal, occupying the centre of the style, but not opening between the stigmata in the fully developed flowers. The ovula are attached near the base, and not towards the apex, as in the other genera of this family. Mr. Brown's statement in Captain Flinders's

Voyage, in the Appendix to vol. ii. p. 569, that the ovula are attached to the apex of a central receptacle, must therefore be received with slight limitation.

The ovula in this genus have, I believe, in general a marked correspondence in number with the stigmata, the number of both being most commonly three. In the very young buds, as, for instance, those of a line in length, the future ovula are indicated by papilliform bodies of a homogeneous pulpy structure. They are, as it were, appressed to the surface of the placenta; they soon, however, become elongated, and appear truncate at the apex, which is minutely papillose. The next change takes place apparently with great rapidity, and consists in the protrusion of a tubular membrane from the centre of the apex of the ovulum, in which no opening could be detected previously. This tubular membrane passes down at first in the direction of the axis of the ovulum, but becomes immediately recurved, and passes up on one side of the ovulum, and in close apposition to the placenta.

I have not hitherto seen this membrane in the earlier stages of its formation. At the period to which I have alluded above, the tube may be traced to the point of attachment of, or base of the ovulum, where it ends, or rather begins, in a cul de sac. Immediately at its exit it is somewhat enlarged, but the diameter soon narrows, and continues so until it dilates again at the apex, which frequently shows a tendency to division. Throughout the ascending part of its course it is in close apposition with the placenta. Generally each tube reaches to the apex of this body; and at this point, and occasionally throughout other portions, mutual and tolerably firm adhesion takes place. Each tube is a simple, membranous, closed sac, containing a great number of molecules, which are exceedingly active, especially about the time of expansion of the flower. These molecules vary much in size, the variety depending apparently upon degrees of combination, the very small ones being alone simple. The motion consists of a rapid oscillation, and is frequently accompanied with considerable change of place; the molecules frequently approaching each other and then receding, the line or course which they describe being very irregular. The motion is much more vivid in those parts of the tubes in which the least aggregation of the molecules has taken place. These always appear to be least abundant in that part of the tube contained

within the body of the ovulum. At the period of their greatest activity they are more mobile when contained in the tubes than when they are made to escape into the fluid medium surrounding them. No change, excepting in size, occurs in the ovula up to the period of the application of the male influence to the stigmata. The tubes remain in apposition to the placenta, and continue to be simple, membranous, elongated, closed sacs. There is, perhaps, a tendency in many of the molecules to become aggregated in the dilated apices of the tubes.

Shortly after the period above alluded to exceedingly fine filaments are visible in the canal existing in the centre of the style, down which they pass to the apex of the placenta and become firmly applied to the extreme points of the tubes, more than one being generally found in apposition with each tube. From a solitary entrance I imagine them to terminate in dilated cul de sacs, or rather, to use the French term, in a pâté d'oie; I must remark, however, that in most cases they have appeared blended with the substance of the tubes, although in no case do they appear to *perforate* the membrane. At this time the molecules will be almost invariably found to have lost their motion and to have become densely aggregated into a grumous, opake, central body, reaching from the apex of the tube to the apex of the ovulum. This is, however, frequently interrupted, but I believe that this is to be attributed to pressure during the operation of separating the ovula from the placenta. The tubes now adhere to the placenta, especially throughout the upper two thirds of their length; and on separating them, portions of the cellular tissue of the placenta to which they were applied become detached, and are visible adhering to the membrane of the tubes. Owing to this adhesion the tube itself appears to be occasionally cellular. A vesicle, generally of a globular form, and frequently appearing to contain mobile granules or molecules, is now visible in, and occupying the chief part of the apex of the tube. I have not been able to trace any continuity between this vesicle and the filaments stated to descend through the style to the tubes. The lower margin of this vesicle is in apposition with the upper portion of the grumous, opake, central mass, which I have described above as resulting from an aggregation of the molecules. The part of the tube adjoining the apex of the nucleus is now visibly enlarged. In addition to the molecules which it contains a small central cell is apparent.

which cell is an extension of the inner wall of the corresponding part of the tube, and cuts off the base of this from communication with the ascending portion. Although the fruit of *Santalum* is monospermous, yet the above changes are not, as this would lead one to imagine, confined to one ovulum. The application of the filaments, as might indeed be expected from the situation of the points of the tubes, takes place frequently on all the ovula.

The abortion of these ovula is certainly, therefore, not ascribable to the non-agency of the male influence; neither is it to be attributed to pressure, or indeed to any appreciable cause.

The remaining changes, which in fact constitute the history of the ovulum, are limited, in accordance with the structure of the ripe fruit, to one ovulum. They take place within the dilated part of the tube, in which the single cell, as stated above, is first developed; and they consist in a further development of cells, and in a corresponding increase of size of this portion of the tube itself. It appears at this period opake, owing to its being crowded with molecules, which are aggregated into distinct groups, perhaps corresponding with some cellular division of the interior of this part of the tube. At a still later period this portion is distinctly cellular, and most of the molecules have disappeared; at the same time, the constricted or narrow portion of the tube presents indications of a cellular subdivision. As the development proceeds the cells become more distinct, and end by occupying the whole of the tube. They are developed from below upwards. When these cells are completely developed, the membrane of the tube is not apparently visible; but we have a lax cellular body, corresponding to it in shape, which still remains attached to the ovulum. I should here mention that the tube, from the site of the development of the small cell to its origin at the attachment of the ovulum, never undergoes any change, except, perhaps, a diminution in the number of its molecules. This cellular body continues enlarging, especially at its base, and subsequently becomes a globose body with an apiculus, the point of which continues applied to the apex of the placenta: the original attachment continues perfect. When the young fruit is further advanced, the placenta will be found pushed to one side, and nearly inclosed in a depression of the cellular body. The original attachment of the base of the ovulum and of the tube still continues perfect, and this latter may be found towards the centre of the

depression. As the development proceeds, the cellular body, which has undergone scarcely any change in shape, enlarges and becomes firmer; at its apex a cavity will be seen, which is partially occupied by an oblong, minute, cellular, grumous body, the rudiment of the future embryo. This is attached by its superior margin to the corresponding part of the apex of the cavity, which is formed by excavation: as it continues to enlarge it extends downwards, and its attachment becomes considerably narrower and very slight, and at a rather later period it appears completely detached. As the cellular body continues to enlarge, it becomes whiter and of a firmer texture, and the embryo becomes oblong and cellular, the tissue towards its apex is more grumous and dense, and immediately above this part there is a degree of constriction visible. As the fruit advances towards maturity, the endocarp, which has already assumed the appearance of albumen, diminishes, and the mesocarp begins to be indurated. The cellular body is now nearly globular, white, and of a dense texture; its component cells being loaded with granules of fecula. The apex of the embryo now becomes lobed, indicating the commencement of a cotyledonary division; its attachment is exceedingly fine, and it is itself evascular. The subsequent changes in the fruit consist in a still further diminution of the endocarp, which is subsequently reduced to a spongy lax coating, adhering both to the now osseous mesocarp and to the albumen. The sarcocarp terminates by becoming baccate. In the seed they consist of an enlargement of the albumen (originally the cellular body); its apiculus finally almost totally disappearing. The division of the cotyledons increases, and has reached to a considerable extent before the tissue of the radicle becomes, as it were, condensed. The cotyledons are, during the first part of their development, somewhat conduplicate; they terminate by becoming elongated and plane on their internal appressed faces. The perfect radicle is ovate, tapering to a fine point.

From this statement it will at once appear that the mode of development of the ovula of *Santalum* is different from that which usually obtains. The cellular oblong bodies which are attached to the placenta are evidently the ovula, and have the appearance and cellular structure of the nuclei of ordinary ovula. The membranous tube from its anatomy answers, I think, to the sac of the amnios, which in ordinary structures lines the cavity formed in the

nucleus at some period previous to fecundation, and which, at least in its earlier stages of development, is the only coat that is membranous. If this view be correct, the anomalies will be reduced to the formation of the albumen, or rather, tissue of the amnios and embryo externally to the nucleus, and to the application of the male influence to the apex of the sac of the amnios instead of to that of the nucleus.

This seems to me to be the best explanation of this anomalous development, although there is no appreciable reason why such an extraordinary modification should be adopted. The mode of development has some analogy to that of *Loranthus* and *Viscum*, with which it agrees in especial in the albumen being destitute of a proper integument. I may, perhaps, be borne out in giving it as my opinion that *Santalum* forms the connecting link between the simplest form of ovulum, as exemplified by *Loranthus* and *Viscum*, and the ordinary and more complicated form of these organs. Another mode of explanation is obvious, by adopting which the male influence would be supposed to operate on the usual spot, viz. the apex of the nucleus; but as the anatomy of these parts does not confirm the supposition, and as the number of anomalies are not reducible to such an extent by this as by the explanation adopted above, I prefer the opinion that the ovula are reduced to nuclei, and that the "seed" of botanists is developed externally to this, and consists of, or is reduced to a naked albumen and an ordinary embryo.

I shall not enlarge on the changes that take place after the supposed action of the male influence until at a subsequent period I have demonstrated the continuity of the filaments with the grains of pollen adhering to the stigmata. The fitness of the present subject for attempting to ascertain rigorously what the first changes incident on this action actually are, is at once very obvious, and close examination will probably put us in possession of very important results.

EXPLANATION OF THE PLATES.

I beg to remark, that with regard to the measurements, they are all taken from the base of the proper pedicle of the bud, or ovarium, or fruit to the

apex of the perianth, or the apex of the remains of the style. No dependence is, however, to be placed on mere measurement, since the development of the ovulum does not always correspond to that of the fruit.

TAB. I.

Fig. 1. Represents the obtuse placenta from a flower-bud ½ a line long, towards the base of which 2 ovula are visible; these are at this period papilliform, and have no indications of distinction of coats or openings through these.

Fig. 2. Ditto of a flower-bud, ⅔rds of a line long. The placenta is now elongated towards its apex. The ovula have assumed their mature form. There is still no trace of distinct coats, or of openings in them.

Fig. 3. Ovulum detached, with a portion of the placenta, from a bud of about the same size (⅔rds of a line long). It is a cellular mass, somewhat truncate, the cells being most lax at the apex. It resembles in form and structure the nucleus of the ovulum of other plants.

Fig. 4. Represents the placenta of a flower-bud about a line long.

The placenta is still more elongated. Towards its base two ovula are visible, the corresponding two being necessarily concealed. *a*. Represents the part of the tube at its exit, and when its course is downwards, nearly in the direction of the axis of the ovulum.

b,b,b,b. The upper portions of these prolongations, which terminate in cul de sacs, and contain, as it appears, at least with a small magnifying power, grumous matter. These tubes are separated artificially from the placenta; they have not as yet completed their growth.

Fig. 5. Placenta and ovula of a flower some time after expansion, and when the segments of the perianth have become of a dark blood-colour. Two ovula are seen *in situ*. The tubular prolongations from the bases of the ovula upwards to their apices are somewhat detached, owing to the object having been immersed in water. Several exceedingly fine filaments are visible attached to the apex of the placenta, and to the corresponding parts of the tubular membranes. The molecules have become aggregated, and appear to form (in the right hand ovule at least) a grumous opake line of communica-

tion between the apex and the exserted part of the tubular membrane.

Fig. 6. Ovulum about the same period, highly magnified, and cut through longitudinally. The included part of the tubular membrane and its origin in a cul de sac are traceable. The exserted part is slightly swollen. The molecules were beginning to become aggregated in this part and in the apex. They were all highly mobile, especially those in the narrow portion of the membrane.

TAB. II.

Fig. 7. Ovulum from the placenta of an ovarium just after the fall of the perianth. In this the filaments are seen attached to the extreme apices, and are apparently intimately confounded with the structure of the membranes. Within the dilated apex a very distinct vesicle or sac is visible, attached apparently by its superior margin, and containing a few mobile molecules. The appearance of molecules in this vesicle may, and probably does result from the presence of some between the vesicle and upper surface of the tube. Extending downwards from its inferior margin, there is a grumous irregular process, which reaches to the dilated exserted portion. It is broken in several places, probably from pressure. Near its apex and adjoining the vesicle globular bodies are seen adhering, of the nature of which I am entirely ignorant. Within the dilated exserted portion, and which is nearly transparent (with the exception of one part), the outlines of an internal sac are visible, which appears to taper superiorly towards the point where it is in contact with the grumous process. This process I have stated before to arise from an aggregation, or rather agglutination, of the originally distinct and active molecules. Within this fine cellular outline, and in juxtaposition with the apex of the ovulum, there is a cellular grumous body of a nearly globular form. The included portion of the tubular membrane is traceable.

Fig. 8. The fecundated ovulum from a placenta of an ovarium two lines long. The apex of the ovulum remains *in situ*; part of the included portion

of the tube is visible from the ruptured apex, of which molecules are escaping. To the dilated apex of the tube two filaments and some remains of cellular tissue are seen to adhere; cells are likewise seen adhering to the margins of the upper half of the tube. The vesicle is visible within the dilated apex, and appears to be continuous with the grumous process. At its base 4 globules are seen. The upper half of the grumous process is very distinct; below this, however, it is broken up. The commencement of the development of the basilar inner cell is distinct, but its intrusion has not yet taken place.

Fig. 9. Represents the dilated exserted part of the membranous tube of an ovulum, from an ovarium $2\frac{1}{4}$ lines in length. This is torn partially, so as to expose what appears to be a large cell with very fine walls. Within this the innermost small cellule is visible, and appears filled with grumous matter. The faint line visible at its base, and which appears continuous with the second fine cell, marks its line of origin. The constricted, or rather, narrow exserted portion, is occupied also by molecules in a state of aggregation. The apex of the nucleus remains.

I may here remark that I am by no means certain of the existence of the fine large cell above mentioned. The innermost small cellule exists, I may almost say, invariably.

Fig. 10. Represents an ovulum from an ovarium $2\frac{1}{4}$ lines in length. The apex of the ovulum alone remains. The base of the membranous tube is much enlarged, and has evidently become cellular. At the same time there is much less granular matter (molecules) observable in its tissue. This cellular part appears to be prolonged upwards in the form of 2 or 3 cells. *a, a, a*. Between this part and the apex there is much grumous matter, composed almost entirely of small granules, and which presents traces of subdivision, the tendency to subdivision being most distinct at the apex. Adhering to the margins of the tube towards its apex, remains of the cellular tissue of the placenta are visible. The vesicle is very distinctly seen within the apex, the extreme part of which appears sphacelated. To it a filament is seen adhering.

Fig. 11. Represents the fecundated ovulum of an ovarium 3 lines long. A portion of the nucleus remains, beyond which can be seen the termination of the inclosed part, or rather, the origin of the tube. The attachment of this is visible by an expanded portion at *a*, and no change is seen to have taken place from this part to the origin of the tube. Two grumous irregular masses are visible between the apex of the ovulum and the attachment of the unchanged portion of the tube. The still more enlarged exserted portion, and rathe. more than the lower half of the tube, have become cellular, the cells containing a good deal of grumous matter. The upper part of the tube likewise appears cellular; but this, I think, results from the adhesion of the cells of the surface of the placenta. On one side of the apex of the tube a protuberance is seen; the only instance that has hitherto occurred.

To its apex a filament is seen adhering, and this part is of a yellowish brown colour. The vesicle is not visible. Three small cellular-looking bodies are seen within the apex. I should remark, that the edges of the upper finely-cellular portion of the tube appeared to be double.

Tab. III.

Fig. 12. Placenta of an ovarium upwards of 3 lines in length. It is at this time of a decided brown tint, the green having disappeared. A fecundated ovulum is visible *in situ*, of which almost the entire original membranous tube has become cellular. On the opposite side of the placenta the apex of an unchanged tube is seen to project upwards.

Fig. 13. Placenta and fecundated ovulum of a fruit $2\frac{1}{3}$ lines long *in situ*. The placenta is pushed towards one side of the cell of the fruit, and is a good deal compressed. It is attached chiefly by branched fibrous tissue, which contains molecules.

Fig. 14. Longitudinal section of an ovarium $3\frac{2}{3}$ lines long. No induration has taken place in the pericarpial walls. The endocarp is white, fleshy, of considerable thickness, and closely resembles albumen. A brownish line is seen passing through the remaining base of

the style to the apex of the cell. The placenta is pushed completely to one side, and from the enlargement downwards of the cellular body, their bases do not correspond, as in fig. 13. A cavity is apparent at the apex of the cellular body.

Fig. 15. Represents its longitudinal section.

Fig. 16. Embryo in a very young state from the same; it is somewhat dilated, and more dense at its inferior free extremity.

Fig. 17. Ovulum and placenta of a fruit $3\frac{1}{2}$ lines long, showing the situation of the placenta.

Fig. 18. Barren (or rather abortive) ovulum from the placenta of the same; very few globules or molecules are visible, and they are either stationary or sluggish.

With this exception it agrees with the abortive ovula examined in earlier stages.

Fig. 19. Represents a long section of the cellular body at a period later than that of fig. 15. The embryo is seen *in situ.*

Fig. 20. The same embryo detached. The apex of the cellular body remains, and to this the embryo is seen to be attached. There is an evident commencement of the cotyledonary division visible at its lower extremity.

Fig. 21. Embryo from an ovarium 4 lines long. The fruit is now nearly at its full development; the mesocarp is indurated, and the endocarp is reduced to a spongy coating, which adheres to the indurated, nearly osseous mesocarp, and likewise to the "albumen." This body now occupies the entire cavity of the fruit, and has assumed its mature form; it is white and fleshy, and abounds with fecula. The embryo is about 2 lines long, it is included in the "albumen," but is not exactly axile. The apex or radicle is ovate and attenuate, and points to the upper portion of the "albumen," and towards the apex of the placenta, which is still visible, lodged in a depression on its surface. The cotyledons are plano-convex, mutually applied by their plane faces. The plumula is inconspicuous.

I trust that the accompanying sketches will be found sufficient.

The structure of the fruit is sufficiently well understood, and hence figures of this are unnecessary. My principal object has been to show the changes that take place in the ovulum throughout its earlier stages, and especially to point out the extraordinary situation of the embryo.

The explanations of the figures are carried down to the nearly mature state of the fruit; the only considerable subsequent change being the conversion of the tissue between the now osseous mesocarp and the cuticle into a baccate pulp.

M. Gauci lith.

III. *Notes on the Development of the Ovula of* Loranthus *and* Viscum, *and on the Mode of Parasitism of these two Genera. By* William Griffith, *Esq., Assistant Surgeon in the Madras Medical Service. Communicated by* R. H. Solly, *Esq., F.R.S. & L.S.*

Read June 21st, 1836.

I SHALL take as the type of the evolution of the ovula those of *Loranthus Scurrula.*

At the earliest stage, that I have submitted to examination, I find that the ovarium is intimately adherent with the parietes of the calyx; its shape being merely indicated by lines of a denser tissue than the rest. The broadest part is situated towards the apex of the tube of the calyx. It is hence prolonged upwards, and terminates by being continuous with the tissue of the base of the style. It is prolonged likewise downwards into a long subulate process, which is continuous with the tissue of the pedicle. In the centre of the broader part a transverse opake line of tissue is visible. The tissue composing the calycine parietes is nearly homogeneous; nor is there any rudiment whatever of a viscous formation*. If we examine a flower shortly, or even immediately, before expansion, we find that in addition to the above, there is a brown, as it were, sphacelated line which runs along the centre of the style and the upper prolongation of the ovary to the centre of the transverse opake line; here it is thickened, and either ceases or spreads transversely on either side in the direction of the opake line. At this part there is evidently a small swelling, and the tissue has become more transparent†. These two changes are owing to the commencement of an excavation formed by the dislocation of the originally continuous tissue, and which communicates freely with the canal apparently existing in the style, along the sphacelated line. Almost simultaneously with the appearance of this excavation the formation of the

* See Tab. IV. fig. 1. † Ibid. fig. 2.

viscous tissue commences, which is, even in its early stages, of a green colour. Just after the fall of the corolla no change of any importance has taken place. There is a greater development of the viscous tissue, and the excavation is larger and nearly filled with broken-up tissue. The canal leading from it appears diminished, but is still distinct. Some time after the fall of the corolla we find the excavation is considerably increased and partially occupied by broken-up tissue*. The viscous tissue is considerably developed, and the greater part of it contiguous to the ovarium has become of a beautifully rich green colour.

Soon after this a small cellular body appears attached to that part of the excavation immediately opposite to the termination of the sphacelated line. This is the rudiment of the ovulum. When the fruit is about half formed the above parts have only undergone an increase in size. Both layers of viscous tissue are well developed, the green one being in intimate contact with the ovary. The base or termination of the sphacelated line is still distinct. The ovulum is between cordate and ovate, its circumference being tinged with pink; and it now has the appearance of albumen. Occupying a niche in its centre we observe the young embryo. It is at this period totally included in the albuminous-looking body, and is suspended by a flat cellular funiculus from the part of the envelope, corresponding to the termination of the sphacelated line; it is oblong, cellular, and presents no trace of cotyledonary division†.

The subsequent changes are confined chiefly to the embryo. As its development proceeds, the division of the cotyledons becomes manifest, and soon extends throughout rather more than half of its length‡. The funicle equals it in length, and is as well as the embryo itself entirely cellular. As it advances in size the embryo ceases to be oval, and appears as if pulled out into a more elongated form, its base or radicle becoming at the same time thickened. The division of the cotyledons continues to be apparent for some time, but ceases to be so at length from the adhesion of their contiguous faces. There is, however, always a certain degree of obliquity at their apices, which enables us to recal their original separation. No union takes place by their immediate bases§.

* See Tab. IV. fig. 4. † Ibid. fig. 5. ‡ Ibid. fig. 6. § Ibid. fig. 8 & 9.

The fully developed embryo is oblong, clavate, the radicle forming the thickest part; there is a slight narrowing about the junction of the cotyledons with the radicle. In the centre of this part two oblong foveolæ or sulci are observable, which owe their existence to the non-union of the bases of the cotyledons*. The plumula is small, but totally concealed, unless indeed the cotyledons are cut away. The embryo is attached very slightly by a very fine short membrane, the originally long funiculus having disappeared. This disappearance is, I imagine, not real; probably the tissue of the funiculus contributes to the formation of the embryo. The coloration of the embryo keeps pace with its development. Throughout its first stages it is colourless; the green colour is first visible about the time that the division of the cotyledons appears, and it continues increasing as the embryo approaches nearer and nearer to a state of perfection.

At this time it is entirely green, the colour differing however in tint; the radicle, particularly towards its apex, being tinged with yellow. The greatest development of green is at the base of the cotyledon, about the sulci or clefts.

With respect to the changes that have taken place at the time of maturity of the fruit in the calyx and ovarium, I must mention the total disappearance of green viscous tissue. The whole cellular substance between the outer layer, or cuticle of the calyx and the ovarium, is converted into a yellowish transparent viscous matter. This is not, however, prolonged down the stalk of the ovarium, which is now fibrous†. With respect to the ovarium, the only remarkable circumstance is the softening down and conversion of a portion of its texture, particularly towards its apex, into viscous tissue. This often occurs to such a degree that the naked radicle is imbedded in the viscous tissue, and is no doubt intended to remove any impediment to the occurrence of germination.

In two or three other species that I have examined the same phenomena occur; but in these there was no development of green viscous matter, nor any colouring of the albumen. In one species the cotyledons were consolidated, and two natural clefts existed; in the other, they were merely applied face to face, consequently no clefts were present or necessary. But independent of these, and of changes of form dependent on specific difference, I

* See Tab. IV. fig. 9. † See Tab. V. fig. 1.

observed the same complete adhesion of the ovarium and calyx; the same original solidity; the same subsequent sphacelation visible along the centre of the style, and terminating at the site of the future excavation; the same excavation; the same subsequent appearance of the ovulum; the same formation, inclusion, cotyledonary division and evascularity of the embryo; the same apparent shortening and almost total disappearance of the funiculus; the same nudification of the apex of the radicle; the same degree of coloration, and the same softening down of the ovarium. This in one species is carried to such an extent that only a portion of the base of the capsule remains in its original fibrous state; so that the greatest part of the albumen and immense radicle are enveloped by the viscous tissue*.

Ovula of Viscum.

In the earliest stage at which I have been able to examine the ovulum, I find a similar adhesion of the ovarium and calyx. The outline of the former is distinct, and the communication of its apex with the central canal leading from the base of the style open and very free†. There is no development of viscous tissue. Towards the apex of the ovarium there is a cavity communicating with the canal leading from the stigma containing a cellular, mammilliform, central, but not papillose body, attached by a broad base, its apex touching almost the termination of the canal. This is connected inferiorly by a thickish opake line running through the centre of the ovarium to its base. This line is evascular, and consists merely of rather dense tissue. At this period the nipple-shaped process, as I may call it, is brownish‡.

No important change occurs until after impregnation; the only intermediate ones being the diminution of the diameter of the canal, and its greater length after impregnation, so far as may be judged of by the sphacelation of the stigma, the process is very apparent; it is enlarged, and its apex more attenuated. From the base of the central line, which runs from the base of the process to the corresponding portion of the ovarium, two brown lines are apparent, curved upwards and outwards. These lines are of a much deeper brown than the rest of the process; corresponding to one of the terminations of the curved lines there is a small lateral excavation, which is partly occupied by broken-up tissue, partly by a sac which is attached to, and hangs from that

* See Tab. V. fig. 5 & 6. † Tab. X. fig. 1. ‡ See Tab. X. fig. 1, 2 & 3.

part of the process corresponding to the termination of the curved line*. This sac consists of a single cell or vesicle enclosing many grumous, opake, ovate, or angular bodies; it has a broad attachment, and is the rudiment of the ovulum†. Simultaneously the viscous tissue has made its appearance.

As the development proceeds the viscous tissue increases, the sac enlarges and becomes cellular, and its attachment narrower. It soon assumes a broadly-obovate form, its attachment becoming at the same time exceedingly narrow. At this period a vesicle is seen inclosed within the tissue at the commencement of its narrow neck‡. This tissue soon assumes the appearance of albumen. The viscous tissue is well developed, occupying the whole of the apex of the fruit (the prolongation of the canal remaining isolated in its centre), and extending to the base of the fruit, to which point it gradually narrows. The figure of the ovarium has changed, four or five prolongations beginning to appear towards its apex. No change has taken place in the process, and the two brown curved lines are still visible. Its stalk, as the albuminous-looking ovulum enlarges, becomes pushed on one side. The ovulum reaches a considerable development before any change in the embryo occurs. When its cornua begin to appear, the embryo is globular, cellular, exceedingly minute, and attached to the nipple laterally. It is not entirely enclosed, but lodged in a cavity in the albumen§.

When the fruit is about half developed, the parietes of the ovarium are indurated, and its prolongations are very distinct. The ovulum, which has for some time assumed the appearance of albumen, and the form of the ovarium, has 4 or 5 horns corresponding to the prolongations of the former, and as many obtuse angles. The stalk of the process has become detached from the surrounding tissue, except towards its base, and is pushed considerably to one side. The apex of the process is slightly elongated and papillose. The embryo has increased and assumed a more oval form; it has likewise become central, that is, it occupies the axis of the albumen. As the fruit increases in size, the embryo becomes unequally emarginate at the apex, indicating the first trace of a cotyledonary division‖. No further changes take place in the other

* Tab. X. fig. 3.

† Tab. X. fig. 1.

‡ Tab. X. fig. 4.

§ Tab. XI. fig. 10, 11 & 12.

‖ Tab. X. fig. 4. & Tab. XI. fig. 14.

tissues except in size. When the embryo is about half developed, the cotyledonary division is deep, and the radicular end small; but as the development proceeds, the cotyledons, which were always rather unequal, become united, except at their immediate bases, corresponding to which sites two indistinct clefts may be found. At the same time the radicular end has become much enlarged*. Throughout its development the attachment of the embryo to the process is slight, and very easily ruptured.

Finally, in the perfect fruit we find the viscous tissue occupying the whole space between the outer calycine layer and ovarium; this is fibrous, somewhat indurated, obtusely 4- or 5-gonal, and prolonged upwards into as many points as there are angles. The albumen is colourless, fleshy, and of the same shape as the cavity of the ovarium; the embryo is clavate, lodged in the apex of the albumen, beyond which and between its cornua the naked apex of the root may be seen to project†.

The development in both the above genera is pretty nearly the same, if we except the want of the mammilliform process in *Loranthus*, and the unimportant circumstance of the attachment of the embryo of *Viscum* being short. The following conclusions may therefore be applied to both.

1. That the calycine parietes are from an early period intimately connected with the ovarium, and that the whole tissue between the outer calycine layer and ovarium becomes subsequently converted into viscum.

2. That there is a tendency, varying in degree, in *Loranthus* in the ovarium itself to become softened down into viscum.

3. That in *Loranthus* the ovarium is at an early period solid, as it is likewise in *Viscum*, if we look merely to the formation of the embryo.

4. That the ovulum is formed subsequently to fecundation; that its development takes place in a cavity formed by the excavation of part of the tissue of the ovarium.

5. That the excavation commences as soon as the sphacelated line has reached the spot where the subsequent important changes are to be carried on.

6. That the first development of the embryo takes place a considerable time after that of the ovulum; that it is attached to the apex of this by a cellular funiculus; that it is hence itself evascular.

* Tab. XI. fig. 8 & 9.

† Tab. XI. fig. 8.

7. That the embryo is at first included in the ovulum; that in *Loranthus* the funiculus subsequently becomes very short, and the apex of the embryo naked.

8. That the cotyledons, in some, become subsequently united, except at their bases, and in such two lateral slits are visible externally.

General Remarks.

From what has been stated, it will appear that the ovulum is, both in *Loranthus* and *Viscum*, a formation subsequent to impregnation. This remarkable, and, I believe, unparalleled fact, will tend materially to increase the difficulty of understanding or even conjecturing the nature of the first steps in the formation of an embryo. It is evident that it is at total variance with the idea that the ovulum, or female organ, is a nidus adapted to, and necessary for the development of the embryo, which in this view is supposed to be derived entirely and directly from the male. It is needless to add, that it is totally different from the usual development of ovula.

With respect to the first part of the process of development, I may observe that original continuity of tissue is very general, and perhaps universal. And, in particular, I believe the nucleus of an ovulum to be *ab origine* solid; whatever is produced subsequently in its interior being developed in a cavity formed by an excavating process.

Although there can be no doubt from its structure and functions, that the fleshy body in which the mature embryo is more or less contained is albumen, yet it may be proper to state in what part of the tissue the necessary change is carried on; particularly since there is, I believe, no instance of albumen occurring as a primary formation*.

The albumen in both these genera may, therefore, be classed with those

* Although I have not proved the existence of a sac in *Loranthus*, within which the tissue which subsequently becomes the albumen, is formed, yet, from the consideration of *Viscum*, and from the obvious analogy which its sac presents to the sac of the amnios in ordinary structures, I have little hesitation in advancing the opinion that the ovulum in *Loranthus* and *Viscum* is reduced to its simplest possible state, and that the albumen is a deposit within the tissue of the amnios, the sac of which has at an early period ceased to exist, at least as a distinct membrane. Further researches may hereafter establish the fact of the amnios being the only essential part of an ovulum.

albumina which are developed in the tissue of the amnios and inclosed in an ordinary integument or integuments, with this obvious difference, that in the subjects under consideration this body is naked.

There is an evident resemblance between the nipple-shaped process of viscum, and the often stipitate, free, central placenta of *Santalaceæ*, especially when more than one embryo is developed in the above genus*.

On the Mode of Parasitism.

The only species in which this has been studied in any detail is the *Viscum album*, and even here the statements are not altogether satisfactory. The latest account which I have seen is that of De Candolle in his excellent *Physiologie Végétale*, vol. ii. p. 790, and more fully in vol. iii. p. 1409, where the subject is treated in the usually luminous manner, so characteristic of this distinguished author.

The mature seeds of all the species of *Loranthus* adhere strongly to the substance on which they are applied by means of the viscous matter. This viscum soon hardens, and then has the appearance of a transparent glue. The first changes take place in *L. Scurrula* two or three days after application, and consist of a curvature of the extremity of the radicle towards the support: this extremity when it reaches this point becoming enlarged and flattened†.

It has now the appearance of a sucker, such as those, for instance, of the *Cassytha filiformis*. I am unable to state the precise manner in which the radicle penetrates the bark. The operation seems to require some time, and it is not until it is completed that the plumula begins to be developed. In those species the cotyledons of which are soldered together, the plumula passes out by one of the clefts; in the others by the fissure between these two bodies. The cotyledons in all the species I have examined remain inclosed in the albumen, which substance begins to disappear as soon as the plumula commences to be developed; the cotyledons undergoing a corre-

* Compare the figures 2 and 3 of *Viscum* with that of the placenta of *Thesium linophyllum*. Brongniart *Sur la Génération des Végétaux*, Plate 43, fig. 3. B & C.

† See Tab. VII. fig. 1, 2, 3, 4 & 5.

sponding diminution in size. By the time that the young plant is furnished with a pair or two of leaves the attachment will be found considerably firm. If we cut away the portions of the support, and lay bare the included portion of the parasite, we find that the application takes place entirely between the ligneous systems of both, the fibres of the sucker-like root of the parasite expanding on the wood of the support in the form of a *pâte d'oie**. There is, however, no interchange of structure between them; neither at this period is there any intermixture of ligneous fibres. As soon as the young parasite has acquired the height of two or three inches, when an additional supply of nourishment is probably required, a lateral shoot is sent out, which is, especially towards the apex, of a green colour. This at one or two, and subsequently at various points, adheres to the support by means of sucker-like productions, which are precisely similar in structure and in mode of attachment to the original seminal one.

As the parasite increases in size, these lateral shoots become frequently very numerous, and give origin, I believe, always from those parts immediately opposite to the sucker-like adhesions, likewise to stems and branches. During the same period the fibres of the suckers become more and more imbedded in the ligneous system of the support, owing to the deposition of the new wood of the latter. The fibres of the parasite never penetrate beyond their original attachment, although the later developed fibres appear to have the power of arriving at this point, but no further. This is very remarkable. In the adult plant the sucker-bearing shoots frequently run to a considerable distance, many of the stocks being literally covered with parasites, all of which have originated from one seed. I have seen such shoots, which had taken their course along a decayed branch, become reflexed, and return in quest, as I may express it, of a part capable of affording due nourishment. In all the species of *Loranthus* which I have examined the same phenomena occur, and also in the species of *Viscum* from which the drawings were made. I have reason to believe, however, that in some *Loranthi* and *Visca* the attachment takes place by one spot; in other words, that there is only a primary attachment: such will approximate in form to the *Viscum album*.

The sucker-bearing shoots frequently run contiguous to each other, and are

* See Tab. VIII. fig. 2.

occasionally reciprocally united by "suckers;" in such there is actual communication between the ligneous systems*.

With respect to the parts on which the parasitism occurs, I believe it is entirely dependent on the permanence of their nature. I have met with a solitary instance of the attachment and evolution of *Loranthus* on the leaf of a Guttiferous tree. The plant had reached the height of two inches, and had developed several leaves; no lateral shoot had been sent out. Its base was expanded on the upper surface of the leaf, and the sucker-like root had penetrated the cuticle, and was firmly imbedded in the parenchymatous mesophyllum. Although in all probability this plant would, had it been left to its own fate, have perished, yet it might have become, before this had taken place, attached by a lateral shoot to a part capable of sustaining it by its permanent nature. I am also of opinion that attachment will take place on any plant†, or part of a plant, the duration of which is sufficiently long. Those with milky juice, though perhaps a general, are not an universal exception.

I have met with a species flourishing on the *Artocarpus integrifolia.* The juice of this species was not milky; it is hence obvious that they have an eliminating power, although the fact stated by De Candolle‡ of coloured fluids passing into their tissue through the stock would lead us to suppose otherwise.

With respect to the bourrelets formed round each attachment, they are occasioned by the deposit of new wood round their bases; they are often irregular, the upper part being, as might be expected, somewhat more developed.

I have never seen any secondary roots sent off either into the interior of the wood, or between the bark and wood§.

* It will be interesting to compare this with grafts, on which subject I am quite ignorant. I think the attachment of *Loranthus* is not analogous to grafts.

† I have seen seeds of *Loranthus* germinating on the succulent fronds of a *Polypodium.*

‡ *Physiologie Végétale,* vol. ii. p. 790; and vol. iii. p. 1411.

§ I have before mentioned that in one species of *Viscum* both primary and secondary *external* attachments take place. A slight examination of another species, in which no lateral shoot had been developed, leads me to suspect that the mode of adhesion of *Viscum album* is not thoroughly understood; and that the appearance of roots running between the bark and wood of the stock is, perhaps, attributable to a peculiar modification of the wood of the latter. Whatever the cause may be with

The influence these parasites possess over the stock is according to their reciprocal size: *L. Scurrula*, generally attached to *Melastoma malabathrica*, or other shrubs, frequently destroys them to a considerable extent. Others, again, which are minute in comparison with the stock, such, for instance, as those that grow upon trees, produce no appreciable deleterious effect.

The foregoing notes apply chiefly to the development of the ovula. I had

the generality of *Loranthaceæ*, with this species it is far different, the primary and secondary attachments taking place by suckers which appear to reach the older formed wood. From the first attachment roots are sent off upwards and downwards. These run to a considerable length, and adhere very firmly by means of suckers, which likewise are imbedded in the substance of the stem.

In this specimen the branches are confined to the stem originating from the primary attachment. The roots, however, have the power of sending off shoots. The suckers produce a most pernicious effect on the branches along which the roots take their course, and from their large size soon produce atrophy.

These roots have the same anatomy as the branches, the medullary rays being less distinct and the medulla almost obliterated; it does exist, however, in a rudimentary state.

The suckers are composed of cellular tissue, and form part of the cortical system, with which they are continuous. The cells are long and arranged at right angles with the woody system. No cuticle covers the adhering surface of the sucker.

The pith is excentric, and, as might be expected, nearest the circumference on the side of the adhesion. The more vigorous and older of these suckers pierce the albumen to a greater or less distance; but no identification of substance appears to take place, the fibres of the suckers being at right angles with those of the alburnum. In all probability they have not the power of piercing into the substance of the wood, their greater depth in the older and larger branches being owing to the deposit of new ligneous matter. At the same time a corresponding increase takes place in the sucker, which becomes hard towards its base. The upper bourrelet surrounding the suckers is always the larger.

Tab. IX. fig. 1. represents a sketch taken from a sucker about three inches below the axis; irregular fascicles of woody matter have passed off from the wood into the sucker, into which they penetrate deeply. They all appear to terminate at a short distance from the adhering surface of the sucker, which is entirely cellular, and much less coloured than the rest; it is still large. The terminations of the woody fascicles are generally clavate. So great is this tendency to throw out suckers that when two roots encounter each other, as they frequently do, they throw out suckers and form mutual adhesions. In this case there is actual identification of structure, woody fibrous bundles passing off from both and becoming identified with the wood. See Tab. IX. fig. 4. It does not take place throughout the whole length of the sucker, but is chiefly confined to its upper position.

Tab. IX. fig. 2. represents the original attachment on the apex of a branch. There is in this no union between the woody systems, although the irregular woody bundles have at *a*, nearly reached the pith. Still the edges of the wood of the stock are entire. The irregularities of this, observable at *b*, *c*, depend probably upon an attempt at formation of wood on this side. The depth at which the sucker has apparently pierced is owing in reality to its original attachment, which must have taken place when the stem of the stock was very thin: consequently the pith would be near the surface.

marked down several points for particular study at Mergui during the rainy season; but it is now very probable that a considerable time will elapse before I can recur to this very interesting subject. A particular series of observations is required as to the precise mode in which the radicle, or seminal sucker as it may be called, of the young parasite, as well as those of the lateral shoots, reach the surface of the wood. Observations on those species of Viscum which have a plurality of embryos, and on the exact mode of adhesion of this genus to the stock, will likewise afford many interesting particulars.

EXPLANATION OF THE PLATES.

Tab. IV.

Fig. 1. Longitudinal section of an ovarium of *Loranthus Scurrula*.

a. Parietes of the calyx. *b.* Bases of two petals remaining. *c.* Ovarium. *d.* Its upper portion, where it is continuous with the tissue of the style. *e.* Central, transverse, opake, linear spot, the site of the future excavation.

Fig. 2. *a.* Parietes of the calyx. *b.* Commencement of the viscous tissue. *c.* Ovarium. *d.* Its upper portion, which is now traversed by a brown line passing through the centre of the style; the adjacent tissue being sphacelated. *e.* Extension of the sphacelated line transversely. The excavation has just commenced.

In one instance the tissue of the sucker was prolonged downwards between the wood and bark of the stock. The centre of this prolongation was occupied by a ligneous fascicle.

To show the fact of a non-continuity of tissue, the section must always be carried through the centre of each sucker, and the branch to which it is applied. As these suckers have not a linear but a discoid attachment, a lateral section will give the appearance of an intermixture of fibres.

Fig. 2, 3 & 4. are taken from the same species. I have verified the above in one species belonging to the section *Scurrula*, from which the sketches were taken, and in one of the section *Symphyanthus*.

Tab. VIII. fig. 5 & 6. represents a young plant of a species of *Loranthus*, attached by a broad base to an elevation of corresponding breadth of the branch, which, however, it overlaps: see fig. 7. The elevation visible in the branch is produced by the passage of the roots of the parasite under the bark. They expand so as to form what the French term a *pâté d'oie*. Here, again, the roots do not penetrate beyond the original attachment.

Fig. 3. The same figures have the same references. The excavation has now increased, as is evident by the greater transparency of the tissue at *e*.

Fig. 4. The figures refer as before. The viscous tissue at *b* is now considerably developed, and of a fine green colour; at *d*, the discoloured brown tissue of the apex of the ovarium, with the remains of the central brown line, is visible, and at *e*, a large excavation, occupied chiefly by dislocated cellular tissue.

Fig. 5. *a, b, c, d* refer as before. The tissue at *d*, is, however, more blended with that of the calycine parietes, excepting its base, which is still brown. The parietes of the ovarium *c*, are reduced superiorly to a great thinness, owing to the development of the albumen at *e*. *f*. Is the incomplete embryo with its cellular funiculus.

Fig. 6. A more advanced embryo detached, with the base of the albumen. *a*. Albumen. *b*. Cellular, lax funiculus. *c*. Embryo. *d*. Its cotyledonary and unequal division.

Fig. 7. Ditto. More, and about half developed. *a*. Fibrous ovarium. *b*. Albumen. *c*. Embryo. *d*. Its radicular extremity, now inclosed almost entirely in the albumen. *e*. Sulcus along its lower portion, indicating the original division into two rather unequal cotyledons.

Fig. 8. Same embryo detached. *d, e*. Have the same references. The cotyledons are now adherent by their contiguous faces, although the sulcus is very evident. *f*. The basilar portion of the cotyledons where they do not become adherent. This subsequently forms one of the lateral slits.

Fig. 9. Nearly mature embryo. *a*. Its radicular end. *b*. The cotyledon; the two being now entirely consolidated except at the basilar point.

There is generally some obliquity about the apices of the cotyledons. The cleft *c* exists on both sides.

Tab. V.

Fig. 1. Mature fruit, separated from the integument of the calyx, and carrying with it the whole of the viscid matter, *a*, which is at this period transparent. *b*. Capsule inclosed within the viscid substance. *c*. Its

stalk. *d.* Marks the termination of its angles, which are the only dense parts in its composition.

Fig. 2. The same, the viscid covering being removed. The angles are seen to terminate in little points, generally three to each. Their continuation down the stalk is likewise shown.

Fig. 3. Longitudinal and central section of a mature fruit. *a.* The viscous tissue which occupies the entire space between the outer part or cutis of the calyx and the ovarium, which is seen at *b.* *c.* The albumen. *d.* Radicular and partially exserted extremity of the embryo. *e.* Cotyledon cut through longitudinally. *f, f.* Situation of both lateral clefts. *g.* The plumula.

Fig. 4. Perfect embryo detached, both lateral clefts are shown.

The above figures refer to the same species as those of TAB. IV.

Fig. 5. Longitudinal and central section of ripe fruit of a *Loranthus,* species unknown. The ovarium is in this species, in the ripe state at least, incomplete, its upper two thirds being dissolved into viscum. The radicle is immense and almost entirely exserted.

Fig. 6. Base of the same ovarium or capsule, albumen and embryo separated from the viscous tissue. At the base of the ovarium is a depression indicating its original connection with the pedicel.

Fig. 7. Embryo detached; the brown apiculus is the remains of the original lax cellular funiculus. One of the lateral clefts is visible.

These three, 5, 6, 7. refer to the same species.

Fig. 8. Longitudinal section of an embryo of *Loranthus,* species unknown. *a.* Its radicular extremity. *b.* Cotyledon. *c, c.* Sites of the lateral clefts. *d.* Plumula.

Fig. 9, 10, 11, & 12, refer to the same species.

Fig. 9. Longitudinal section of the ovarium of a *Loranthus*, species unknown, long before expansion. *a.* Calyx, tissue of. *b.* Ditto, mucilaginous white portion. c. Ovarium, now fibrous; its communication with the base of the style is very distinct.

Fig. 10. Longitudinal section after the fall of the corolla and after impregnation. *a, b, c.* Have the same references as in fig. 9. *d.* The more persistent base of the ovarium, which has undergone but little change.

e. Brownish rather indistinct line running towards the excavation, in which the now imperfect nucleus, *f*, of a cordate shape, is developed. The same phænomena occur as in *Loranthus Scurrula*.

Fig. 11. Longitudinal section of a more advanced fruit; the figures have the same references. The mucilaginous or now viscous tissue, *b*, is much enlarged, and is deposited in cavities, which appear to be tolerably distinct from each other; the two basilar ones, as in some others, are the largest. *d.* The diminished remains of the basilar part of the originally dense ovarium; it is the persistence of this portion that causes in part the production of the horns of the albumen. The line *e* is very distinct, and the tissue forming the margins of the now large cavity much sphacelated.

f. The albumen considerably altered in shape. *g.* The young embryo attached very slightly to the part of the albumen corresponding to the termination of the line *e*.

Fig. 12. Embryo detached to show the large evascular funiculus.

Tab. VI.

Fig. 1. Longitudinal section of an ovarium of a *Loranthus*, species unknown, a short time after the fall of the flower. *a.* Outer tissue of parietes of the calyx. *b.* Inner ditto commencing to become viscous. *c.* Ovarium. *d.* Its base and denser portion, which produces the same effect on the albumen as above noticed. *e.* The line descending from the apex of the remains of the conical base of the style. *f.* Ovulum.

Fig. 2. Section not truly central. *a*, *b*. Refer as before. *c.* The fibrous walls of the ovarium. *d.* Its stalk, which is surrounded by viscous tissue.

The sphacelated apex of the remaining base of the style is evident. The communicating sphacelated line *e* has disappeared, the tissue continuous with the base of the style being truncate. *e.* The broad cellular attaching process of the albumen. *f.* The albumen: rudiments of two of its ascending cornua are visible. *g.* The embryo hanging down into a cavity formed in the albumen by excavation.

Fig. 3. Embryo detached. Its funiculus is long, loosely cellular, and evascular.

far exceeding in bulk the embryo itself, in which the first trace of a cotyledonary division is visible.

Fig. 4. Central and longitudinal section of a ripe fruit. *a, b.* The two divisions of the tissue of the calyx now nearly similar. *c, c.* The basilar portion of *b*, which remains uncoloured and has a mucilaginous appearance. *d.* Remains of the stalk of the ovarium. *e.* Sphacelated communicating line, reaching to the apex of the radicle and traversing the original suspending process *f*, of the albumen *g*, of which two large ascending, and two minute descending cornua are visible. *h.* Embryo, with its radicle situated between the ascending cornua of the *testa.*

Fig. 5. Capsule separated: the white lines represent its denser angles, from which processes are sent out into the albumen; alternating with these are six furrows, along which the texture of the capsule, here very fine, dips into the albumen.

Fig. 6. The albumen and embryo removed from the integument; the albumen is 6-cleft, the fissures at its apex being acute: between the corresponding basilar obtuse ones, and projecting beyond them, is the truncate subpeltate radicle.

Fig. 7. Transverse section of albumen and cotyledons.

Fig. 8. Embryo detached.

Fig. 9. The same; its cotyledons, which are always distinct, being separated. The very small plumula is not visible.

The whole of the figures of this plate refer to one species.

Tab. VII.

Fig. 1, 2, & 3. Detached embryos of *Loranthus Scurrula*, showing the first changes that take place after the application of the ripe fruit to the bark of a tree.

Fig. 4. Embryo of the same more advanced in germination; the commencement of the "sucker" is now visible.

Fig. 5. Fruit of *Loranthus Scurrula* cut through longitudinally, showing the first changes *in situ.*

Fig. 6. Germinating embryo of a *Loranthus*, species unknown, the albumen remaining attached and inclosing the cotyledons.

The radicle of the parasite has not yet pierced the bark of the stock.

Fig. 7. Ditto. Removed from its attachments and from the embryo; the half sphacelated cotyledons are somewhat separated.

Fig. 8. Albumen and cotyledonary end of the same embryo.

Fig. 9. One of the cotyledons and plumula.

Fig. 10. Germination of *Loranthus* rather advanced. The root has at this period perforated the bark. The rudiments of the second pair of leaves are visible.

Tab. VIII.

Fig. 1. Fruit and germinating embryo of *Loranthus Scurrula* cut through longitudinally. The plumula is just exserted; the radicle has not yet pierced the bark of the stock; some of the viscum is seen adhering to the fruit. No change has yet taken place in the cotyledon. The radicle has become whitish in the centre; the irregular shape of the sucker-like portion is visible, and appears to result from the small opening in the parietes of the capsule.

Fig. 2. Ditto, considerably more advanced. The albumen has almost entirely disappeared, and the cotyledon is much shorter.

The root has pierced the bark, the contiguous portions of which are seen to be sphacelated; and its sucker-like extremity is seen to be expanded on the surface of the wood. The first pair of leaves have reached to a considerable size; one, however, is cut away. This is viewed obliquely.

Fig. 3. More advanced state of a young plant of *Loranthus Scurrula?* the upper portion of the stem being cut away.

This shows the great irregularity of the base of the axis of the parasite, the incomplete ring formed round its base in the ligneous system of the stock, and the lateral shoot.

Fig. 4. A similar young plant more advanced, perhaps of the same species: the sphacelated margins of the bark around the base of the parasite,

and its partial destruction, with the course of the lateral shoot, are visible.

Fig. 5. Young plant of a *Loranthus* attached to a stock.

Fig. 6. Ditto. Longitudinal section of the conical base of its axis, together with that of the stock, the bark removed.

Fig. 7. Portion of a lateral shoot of an adult *Loranthus*, with a corresponding portion of a stock, showing their mode of adhesion.

Fig. 8. Portion of the same cut through longitudinally, showing that the sucker has pierced the bark and become applied on the surface of the wood of the stock.

Tab. IX.

Fig. 1, 2 & 3. Different sizes of parasites and stocks cut through longitudinally, showing that however varied the surface of the woody system of the stock may be to which the parasite is applied, there is no mutual communication between the two systems. In other words, the woody systems of the stock and parasite are contiguous, and not continuous.

Fig. 4. Longitudinal section of two lateral roots of *Loranthus Scurrula*, showing that these not only become occasionally attached by "suckers," but that when this does take place, there is an actual, although partial, union between their woody systems.

EXPLANATION OF THE PLATES OF VISCUM.

Tab. X.

Fig. 1. Longitudinal section of an ovarium before the expansion of the flower. *a*. Parietes of the calyx. *b*. The canal running from the centre of the stigma through the upper part of the ovarium, and terminating in the cavity *d*.

c. Ovarium of the same structure with the calycine tissue. *c*, *a*.

Is the opake line of elongated tissue running through the centre of the ovarium, and terminating at the base of the nipple-shaped, cellular process *e*, which is central, and opposite to the termination of the canal *b*, nearly filling up the similarly shaped cavity *d*. 1 *a*. The nipple-shaped process from the same ovarium.

Fig. 2. The same letters have the same references. The canal *b* is diminished in diameter, but increased in length. The tissue of the stigma, and that about the apex of the ovarium is yellow. Taken from an ovarium before impregnation, but during expansion. 2*a*. Nipple-shaped process of the same detached; it has become more conical.

Fig. 3. Longitudinal section of ovarium after impregnation, that is, if the appearance of the stigma may be taken as a proof.

a. Calycine tissue; the viscous tissue has begun to be developed. The line *b* is now closed, and of a light brown colour, and *d* is no longer visible, being entirely occupied by the process *e*: continuous with the line *Ca* two curved brown lines are visible in *e*, the convexities of which look upwards.

(I have never observed more than two lines in this species). A lateral excavation is visible at *f*, the greater part of which is occupied by the body *g*, which hangs from the nipple at the termination of one of the curved lines.

Fig. 4. Longitudinal section of a nearly ripe fruit. The viscous tissue now occupies the chief parts of the calycine parietes, and is internally in opposition with the now fibrous capsule, which is prolonged upwards into four or five horns, of which two only are visible in the section. The communication between the stigma and the cavity containing the nipple-shaped process *e*, is still traceable at *b*. The process *e*, with its two arched lines, has undergone no change. The ovulum *g*, which, I should observe, is reduced to a nucleus, now fills completely the excavated cavity. In the axis of the upper half the embryo is visible *in situ*: it is rather excentric when compared with the axis of the nipple. The original cotyledonary division has disappeared, except towards its apex.

Fig. 5. Ovarium still more advanced. The letters have the same references.

The lateral excavation *f* is much enlarged, as is likewise the young ovulum *g*. The line *C a* is pushed to one side.

5 *a*. Young ovulum detached from the same ovarium.

Fig. 6. Ovulum a little more advanced, detached with the nipple-shaped process, the brown curved lines of which were in this instance no longer visible; the process is rather papillose at its apex.

Fig. 7. Ovarium still more advanced. The excavation has become much enlarged; the ovulum *g* has now attained a considerable size, and has become nearly central. The commencement of its development upwards into horn-shaped processes is visible at *g a*.

Tab. XI.

Fig. 1. Nipple-shaped process detached from an ovarium soon after impregnation.

Its apex is of a light brown colour; communicating with the lower parts of the curved lines is an obscure channel, the edges of which appear of a light brown. This appearance of a channel of communication between the apex of the nipple-shaped process, to which, probably, the male influence is applied, did not appear to be universal or even general. A vesicle filled with brown grumous granules is seen attached to the lower part of one side of the process by a broad base.

Fig. 2. Nipple-shaped process, with the central opake line dissected out. The two curved lines are very conspicuous, and of a rather deep-brown colour. The apex appears papillose. The broad cellular, irregular portion visible on one side indicates the site of attachment of an ovulum.

Fig. 3. Ditto, with an ovulum more advanced, detached with the upper portion of the opake line or stalk. The young ovulum is now attached by a narrower base, and is evidently cellular.

Fig. 4. Ovulum at about the same period of development; the attachment is very narrow: at the commencement of the narrow portion, and in its centre, a globular vesicle is just visible; this is, I imagine, the

rudiments of the embryo. I must state, however, that this vesicle generally eluded observation.

Fig. 10. Ovulum and nipple-shaped process detached; on one side a lateral excavation is visible in the ovulum, in which the embryo (fig. 11.) was lodged.

Fig. 11. Young embryo; the apiculus is the part by which it is attached.

Fig. 12. The same, highly magnified.

Fig. 13. Embryo detached at a later period of its growth.

Fig. 14. Ditto, showing the commencement of the division into cotyledons.

Fig. 7. Ditto, the division still more advanced.

Fig. 6. Albumen detached, one of its (in this case four) cornua cut away longitudinally, to show the cavity in which the embryo is lodged.

Fig. 8. The same entire; the apex of the radicle is just visible between the bases of the cornua.

Fig. 9. Mature embryo detached; the slit and the incompletion of the adhesion of the rather unequal cotyledons are shown.

Fig. 5. Transverse section of a fruit below the situation of the embryo; in this case the ovarium has five rounded angles, each of which is prolonged into a horn.

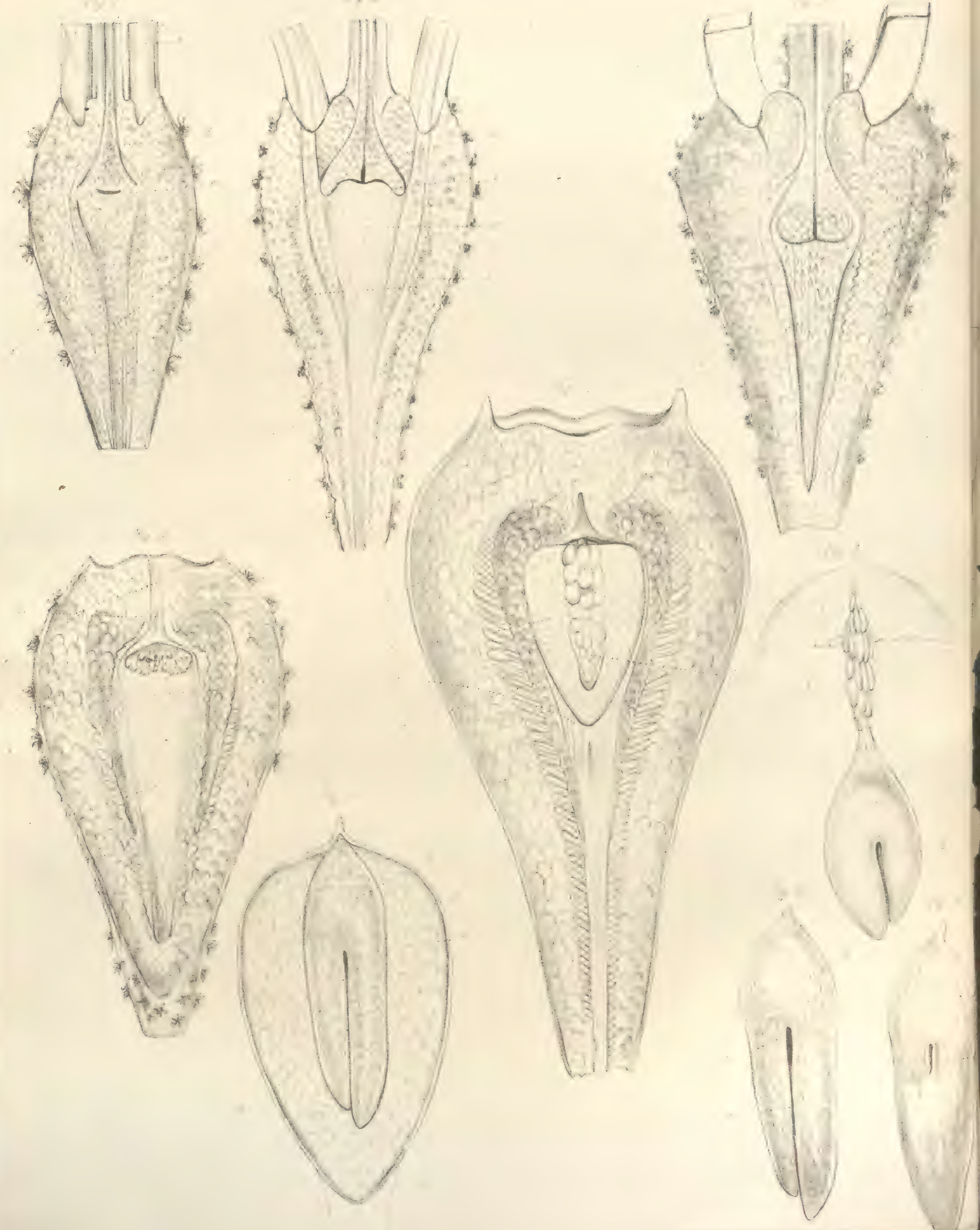

Fig. 2
Fig. 8
Fig. 6
Fig. 9
Fig. 4

Fig. 1

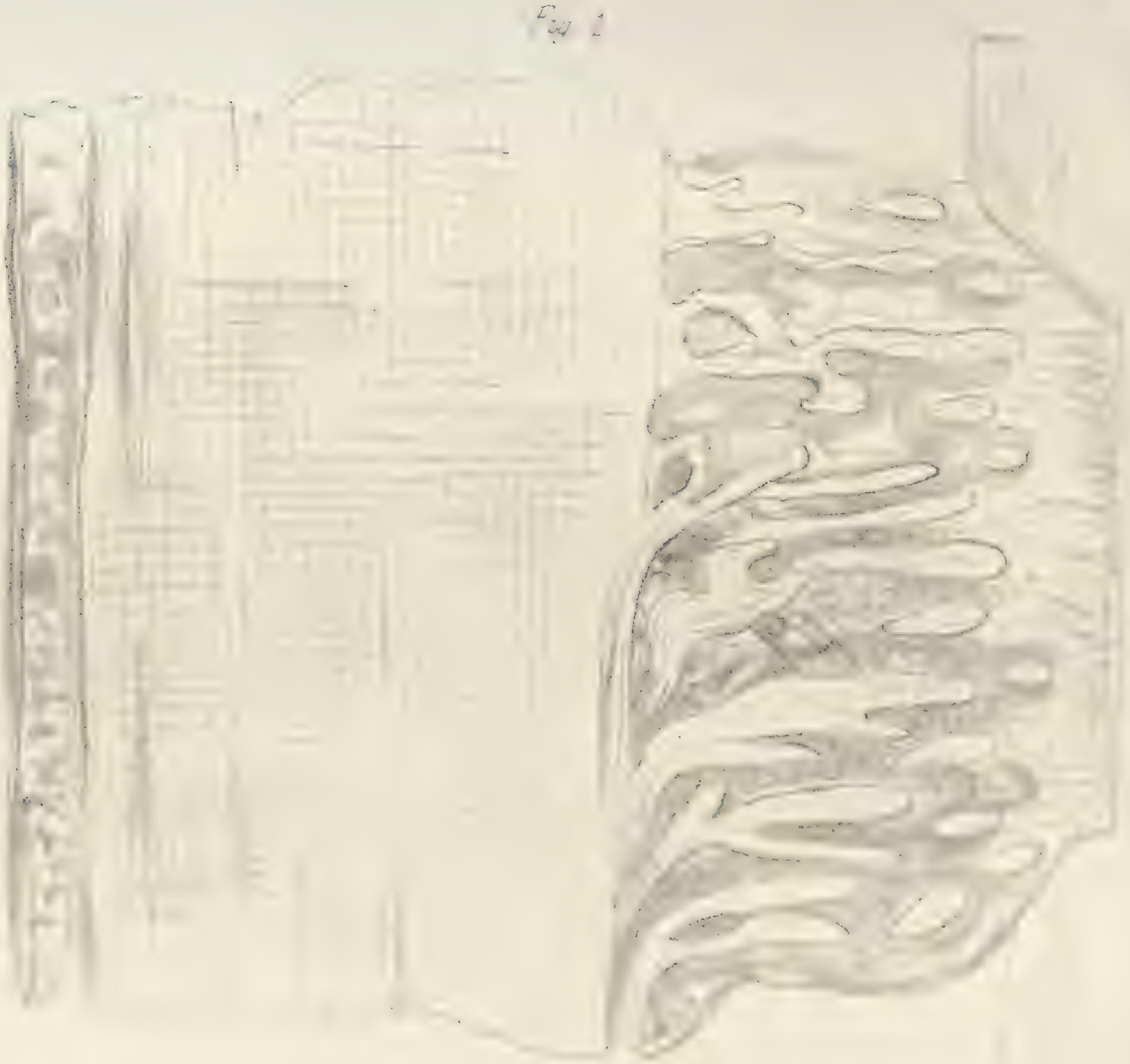

Fig. 4

Fig. 3

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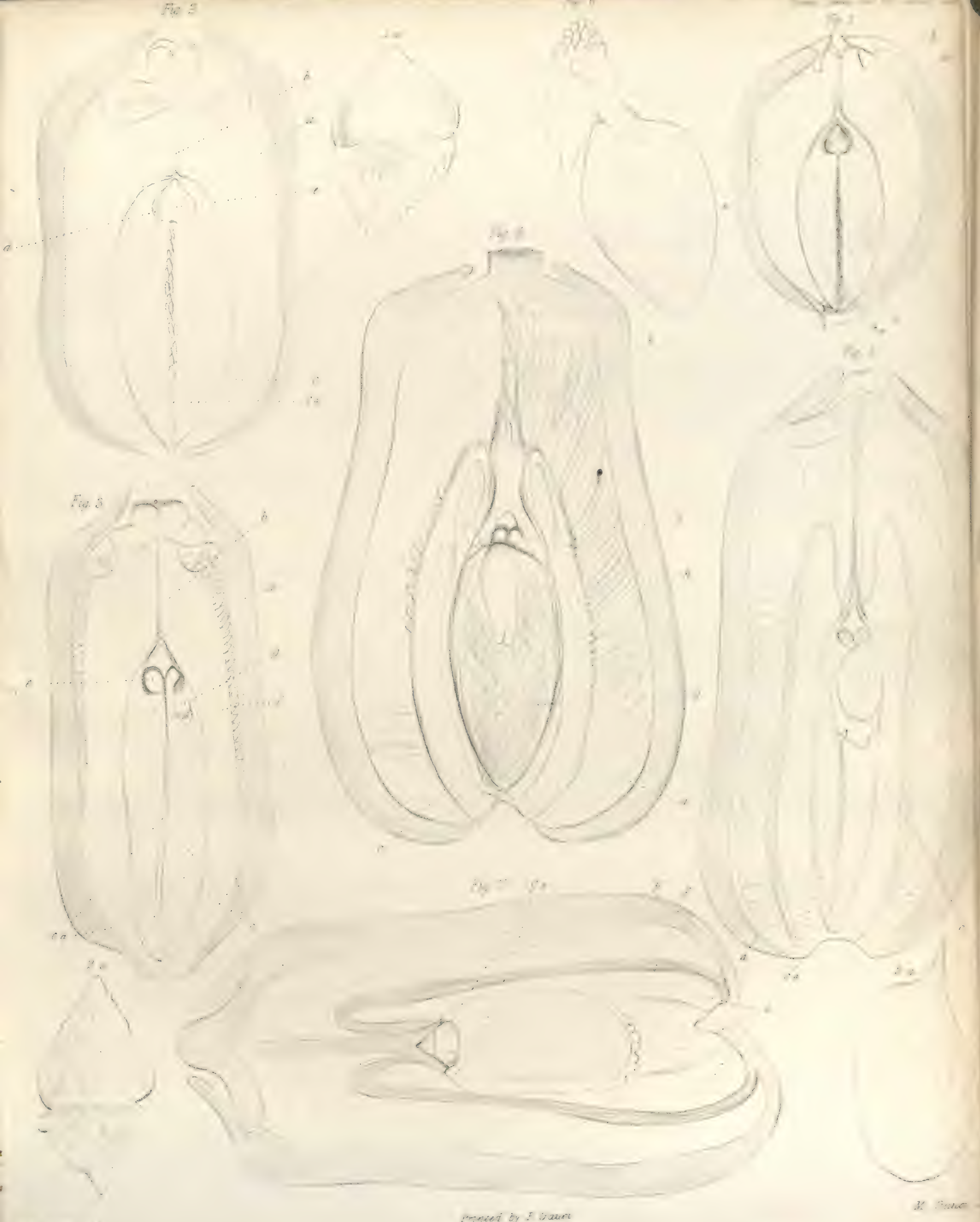

IV. *Descriptions of those species of* Polygonum *and* Fagopyrum *which are contained in the Indian Herbarium of* J. Forbes Royle, *Esq., F.L.S., &c., late Superintendant of the H.E.I. Botanical Garden at Saharunpore, and now Professor of Materia Medica in King's College, London. By* Charles C. Babington, *Esq., M.A., F.L.S., F.G.S., &c.*

Read December 20th, 1836.

My friend Professor Royle having done me the honour to submit to my examination and description those species of *Polygonum* and *Fagopyrum* which are contained in his extensive Indian Herbarium, I have now the pleasure of communicating the result to the Linnean Society. After the valuable monograph by Professor Meisner upon the Wallichian Polygoneæ, published in the third volume of the *Plantæ Asiaticæ rariores,* it was not to be expected that many new species would occur in this collection. I was therefore the more pleased by finding not fewer than ten totally distinct forms amongst the natives of the Himalayan mountains and the upper provinces of India. I would particularly direct attention to the tribe *Avicularia,* in which Dr. Wallich's herbarium is peculiarly deficient. Meisner describes four species, all of them very closely allied to *P. aviculare,* Linn., only one of which occurs in this collection, but the other three are replaced by five most interesting plants, only one of which appears to have been previously noticed.

In all cases in which I have been able to identify my plants with those of Professor Meisner, I have adopted his specific characters, but have always drawn my detailed descriptions from the Roylean specimens which I had before me. My friend, Professor Don, has most kindly given me his valuable assistance, and has added much to the value of this paper by identifying several of Meisner's species with those described by him in his Prod. Fl. Nepalensis.

As this family has been so recently illustrated in the *Pl. Asiat. Rar.*, I have

not thought it necessary to characterise the genera and sections, and must refer to that work for full descriptions of them. I will not trouble the society with any further observations, but proceed at once to the description of the species.

Polygonum. *Linn.*

Sect. 1. Bistorta. *Meisn.*

1. P. bulbiferum.

Spicâ compactâ densâ basi interruptâ laxiusculâ, bracteis ovatis acuminatis subincisis, staminibus calyce brevioribus filamentis post anthesin elongatis, stylis 2 rariùs 3 calyce duplò longioribus, achenio calycis longitudine lenticulari faciebus rotundato-acuminatis minutè granulato-striatis subopacis, foliis caulinis subsessilibus lanceolatis radicalibus petiolatis ellipticis vel elliptico-lanceolatis omnibus in margine revoluto costato-crenatis.

P. bulbiferum. Royle MSS.

Stem simple, striated, smooth, from two inches to more than a foot in height, springing from a thick perennial woody rhizoma. *Leaves* elliptical, often so short as to be nearly round, and others on the same plant so much elongated as to appear lanceolate, upon long stalks; their margins revolute and marked with a series of short elevated transverse striæ, so as to appear crenulated, the under side slightly downy, the cauline leaves lanceolate and sessile. *Stipules* long, cylindrical, splitting laterally and dilated at their top, with numerous nerves which are finely scabrous, or rather, towards the top, very minutely spinoso-pubescent. *Flowers* small, white, in dense compact spikes, the lower parts of which are more or less elongated and interrupted, and bear small bulb-like bodies in the place of fruit; the true flowers are 5-fid, the segments obtuse, stamens 8, the filaments of which before the anthers burst are much shorter than the calyx, afterwards they elongate until they nearly equal the styles which are twice the length of the calyx, and usually two, but in some cases three in number; bracteæ longer than the pedicels, acuminate, obliquely truncate and cut; the pedicels jointed just below the flower. *Fruit* rather large, lenticular, compressed, the faces nearly round and pointed,

rather opake and minutely granulate-striate; the fruit of the trigynous flowers is probably 3-gonal, but none of such occurs on our specimens.

This species may be distinguished from its near ally *P. viviparum*, by its fruit, the length of its filaments, and by the density of the seed-bearing part of its spike. In that plant the fruit is 3-quetrous, and its faces are ovate-lanceolate, smooth and shining, the filaments are twice as long as the calyx, and the whole spike is lax, slender, and elongated.

Lippa in Kunawur.

2. P. macrophyllum. *Don.*

Spicâ compactâ densâ cylindricâ vel ovatâ, bracteis ovatis pedicellis brevioribus: infimis quàm superioribus sæpè longioribus acutè acuminatis pedicellis superantibus, staminibus calycem æquantibus, stylo profundè tripartito, achenio trigono lævi nitido, foliis lanceolatis obtusis in margine revolutis costato-crenatis inferioribus petiolatis.

P. macrophyllum. Don, Prod. Fl. Nep. 70. Meisn. Mon. Gen. Polyg. 51.

P. sphærostachyum. Meisn. in Wall. Pl. Asiat. Rar. iii. 53, non Meisn. Mon. 53.

Stem simple, striated, smooth, a foot or more in height. *Leaves* lanceolate, the apex itself obtuse, the margins reflexed and marked with false crenulations, as in *P. bulbiferum,* the under side often slightly downy, the lower leaves upon long stalks, the upper ones sessile and narrower. *Stipules* long, cylindrical, splitting on one side above, the apex rounded and slightly acute. *Flowers* larger than those of *P. viviparum,* upon rather long stalks jointed just below the flower, red, in a dense compact spike which is not gemmiferous; the flowers 5-fid, their segments obtuse, stamens 8, about as long or rather longer than the calyx; style divided into three parts, but scarcely to its base, and shorter than the calyx, the bracteæ ovate, and shorter than the pedicels; some of the lower ones often having a long acute point by which they are made to exceed the pedicels. *Fruit* 3-gonous, smooth, shining; in a very young state in our specimens.

Kedarkanta in September, and the Chandow Pass in July.

3. P. amplexicaule. *Don.*

Spicis terminalibus solitariis vel geminis longissimis linearibus, bracteis latis plùs minùsve acuminatis imbricatis, calycis segmentis ovali-oblongis, foliis ovatis vel ovato-oblongis basi cordatis sensìm longè acuminatis læviusculis vel nervis prominentibus puberulis margine costato-crenatis subrevolutis: caulinis sessilibus amplexicaulibus.

P. amplexicaule. Don, Prod. 70. Meisn. Mon. 51.
P. ambiguum et *oxyphyllum.* Meisn. in Wall. iii. 54.
P. petiolatum. Don, Prod. 70.

Stem erect, herbaceous, smooth; in some specimens slightly downy below the joints, the internodes very long. *Leaves* ovate or ovate-oblong, their bases cordate and amplexicaul, sometimes shortly stalked, narrowing gradually into a long sharp point, often quite smooth on both sides, sometimes with the nerves, particularly upon the under side, minutely pubescent; the margin costate-crenate and more or less revolute. *Stipules* very long, entire, glabrous, blunt. *Flowers* rather large, in long slender solitary or twin spikes, with very long pedicels jointed just below the flower; the bracteæ broad, imbricated, pointed, the point often very long; the sepals ovate-oblong. *Fruit* 3-quetrous, the faces ovate and pointed, smooth and shining.

After the examination of numerous specimens I have come to the conclusion that *P. ambiguum* and *P. oxyphyllum* of Prof. Meisner cannot be considered as even marked varieties, but form only accidental forms of one species, probably caused by a difference of soil and situation. Prof. Don informs me that this species is *P. amplexicaule*, and also *P. petiolatum* of his Prod. Fl. Nepal. I have therefore restored the former name.

Simla, Nagkanda, Mussooree and Choor. July.

4. P. vaccinifolium. *Meisn.*

"Spicis subcylindricis laxifloris, floribus patulis, foliis brevi-petiolatis ovatis vel ellipticis utrinque attenuatis lævigatis, trunco epigeo ramoso."

"β. medium. *Meisn.* Spicis solitariis, foliis acutiusculis aut breviter acuminatis, ramis suberectis.

"γ. flagelliforme, *Meisn.* Spicis in apicibus ramorum sæpè subpaniculatis, caulibus ramisque longissimis debilibus prostratis."—Meisn.

P. vaccinifolium. Meisn. in Wall. iii. 54.

Stem shrubby, prostrate, very much branched; in β the branches are short and nearly erect; in γ long and prostrate. *Leaves* ovate, attenuated at both ends, usually having a short acute point, the margin slightly revolute, glabrous, reticulated with numerous slightly prominent nerves, particularly on the upper surface, shortly stalked. *Stipules* long, with numerous strong brown nerves, soon torn so deeply as to present the appearance of a tuft of long stiff hairs. *Flowers* in rather long subcylindrical spikes, which are usually solitary, but sometimes slightly panicled, the segments of the calyx oval, stamens 8, styles 3, rather long, the pedicels jointed just below the flower. *Fruit* trigonous, the faces lanceolate, shining, and minutely granulate-punctate.

The variety "*α obtusifolium*," Meisn. does not occur amongst Prof. Royle's specimens.

Kedarkanta and Chandow Pass, September.

5. P. affine. *Don.*

Spicis erectis oblongis solitariis cylindricis, floribus magnis apertis, achenii acutanguli faciebus minutissimè punctato-granulatis, stylis elongatis 2 vel 3 distinctis stamina superantibus, foliis lanceolatis basi attenuatis margine revoluto undulato-crispato, trunco ramisque hypogeis apice tantùm epigeo, caulibus erectis simplicibus.

P. affine. Don, Prod. 70. Meisn. Mon. 52. non Steph. in Spreng. Syst. II., 256.

P. Brunonis. Meisn. in Wall. iii. 54.

Stem woody, subterranean, the branches alone appearing just above the surface, and terminating in short upright stems, each bearing one compact cylindrical spike. *Leaves* broadly lanceolate, acute, the nerves numerous and strongly marked, the margins revolute and crisped, the cauline ones subsessile, the others narrowed into a short stalk. *Stipules* long, entire, blunt, with numerous prominent nerves. *Flowers* in cylindrical, rather

compact solitary spikes, large and open, the segments of the calyx broad blunt, the pedicels jointed just below the flower, longer than the broadly triangular obtuse bracteæ; styles much longer than the stamens, usually 3 and quite distinct. *Fruit* young on our specimens, but sufficiently advanced to show that it is acutely triangular, and the faces minutely punctate-granulated.

Kedarkanta; Lippa in Kunawur, Peer Punjal and Kherang Pass, September.

6. P. emodi. *Meisn.*

"Spicis geminatis angustatis, floribus inapertis, achenii acutanguli faciebus lævibus nitidissimis, foliis angustè lanceolatis sublinearibusque acutissimis utrinque æqualitèr attenuatis margine revoluto integerrimis suprà densè pennatim nervosis, trunco epigeo prostrato ramoso radicante ubique folioso, caulibus annotinis erectis simplicibus."—*Meisn.*

P. emodi. Meisn. in Wall. iii. 51. t. 287.

Stem prostrate, woody, branched and rooting; stalks short, leafy, upright, usually terminating in 2 spikes of flowers, although on our specimens there is only one spike upon each stalk. *Leaves* lanceolate, acute, penninerved, the nerves prominent above, the margins reflexed and entire, very numerous. *Stipules* long, entire, acute, with numerous prominent nerves. *Flowers* in terminal, sublinear spikes, usually 2 together, segments of the calyx 5, ovate, obtuse; stamens 8; style semitrifid, pedicels jointed just below the flower. *Fruit* trigonous, the faces rhombo-elliptical, smooth and shining.

Kedarkanta, August.

Sect. 2. Amblygonon. *Meisn.*

7. P. orientale. *Linn.*

"Spicis paniculatis demùm nutantibus, bracteis acutis, 3—5-floris, floribus patentibus 7-andris, glandulis 7 squamæformibus perigynis inter staminum insertiones, achenii basi obtusi angulis rotundatis lineâ notatis, faciebus suborbicularibus depressis lævibus, ochreis recentioribus hypo-

crateriformibus, foliis ovatis acuminatis in petiolum subdecurrentibus utrinque ochreisque et caule ramoso alto molliter pilosis."

P. orientale. Linn. Sp. Pl. I. 519. Meisn. in Wall. iii. 54.

" β. pilosum, *Meisn.* Spicis nonnunquam erectis strictiusculis, floribus mediocribus, lineâ in achenii angulis subobsoletâ, pube ubique copiosiore longiore sæpiùs ferè aureo-sericeâ sublanugineâ."—*Meisn.*

P. pilosum. " Roxb. Hort. Bengal. 29." Meisn. Mon. 54.

P. orientale β. pilosum. Meisn. in Wall. iii. 54.

Stem erect, branched, thick and woody, deeply sulcate, densely hairy. *Leaves* ovate, acute, upon long stalks, which, together with both surfaces of the leaves, are covered with a dense silky pubescence. *Stipules* long, spreading at the top, blunt, densely covered with hair. *Flowers* in narrow, linear, dense, long panicled spikes, with hairy peduncles; bracteæ ovate, slightly pointed, hairy, finely ciliated and many-flowered, each pedicel jointed just below the flower, and having a rather long paleaceous scale at its base, flowers small, their segments ovate obtuse; style semibifid. *Fruit* lenticular, compressed, its faces round and pointed, smooth, shining, the rounded angles have a minute keel near their base.

α. grandiflorum. *Meisn.* *P. orientale* of his Mon., p. 53, does not occur amongst Prof. Royle's specimens.

Gathered on the banks of the Ganges, July 1820, and near water during the rains at Saharunpore.

Sect. 3. Persicaria. *Meisn.*

8. P. lanigerum. *R. Br.*

" Spicis paniculatis cylindricis densifloris, bracteis pubescentibus muticis pedicellos subæquantibus, floribus 8-andris semi-2-vel 3-gynis, calyce eglanduloso 4—5-fido, achenio lenticulari rariùs 3-quetro, ochreis canescentibus ciliatis, foliis lanceolatis subtùs incano-tomentosis suprà ramisque incanis, caule erecto ramoso basi glabro radicante crasso sulcato."—*Meisn.*

P. lanigerum. R. Br. Prod. Fl. Nov. Holl. i. 419. Meisn. Mon. 70. Meisn. in Wall. iii. 55.

Stem erect, branched, woody, hollow, striated, covered with woolly pubescence. *Leaves* lanceolate, acute, the margins slightly reflexed, covered with short woolly down on both sides, but much more thickly underneath. *Stipules* not ciliated in our specimens, rather long, blunt, covered with short hoary pubescence. *Flowers* in longish, narrow, cylindrical, dense panicled spikes, with woolly peduncles; bracteæ ovate-acute (as described by Meisner in his Monog.), finely pubescent, about 2-flowered, nearly equal to the pedicels, which are jointed just below the flower; flowers small, 4 or 5-fid; the segments blunt; stamens 8; style divided half-way down into 2 or 3 parts. *Fruit* lenticular, compressed, its faces round and pointed, smooth, shining.

Rana Serai. October.

9. P. hispidum. *Don.*

Spicis virgatis geminatis continuis, pedunculis firmis densè pilosis eglandulosis, bracteis imbricatis turbinatis pilosis longè barbatis pedicellos superantibus, floribus 8-andris semi-3-gynis; calyce 5-fido subeglanduloso extùs pubescente, achenii triquetri faciebus lævibus, ochreis longis pilosis longè setoso-ciliatis, foliis elongato-lanceolatis utrinque attenuatis adpressè densèque hispidis, caule erecto adpresso-hispido.

P. hispidum. Don, Prod. 71.

Stem erect, thickly covered with rather long adpressed hairs. *Leaves* elongate-lanceolate, narrowed at both ends, the margin slightly revolute, covered on both sides with short closely adpressed hairs. *Stipules* long, obliquely truncate, densely covered with hair, setose-ciliated. *Flowers* in long slender cylindrical spikes, two together; bracteæ strongly ciliated, longer than the pedicels, which are jointed just below the flower; flowers small, their segments blunt, slightly hairy on the outside and somewhat glandular, 8-androus, semi-3-gynous. *Fruit* triquetrous, smooth, shining.

Gathered on the banks of the Ganges, Aug. 1817.

10. P. barbatum. *Linn.*

Spicis pedunculatis virgatis geminatis continuis, bracteis turbinatis subremo-

tis fuscis albido-setoso-ciliatis 1—4-floris pedicellos superantibus, floribus "6—8-andris" semitrigynis, calyce 5-fido, achenio triquetro faciebus ovatis lævibus nitidis, ochreis laxiusculis longissimè setoso-ciliatis, foliis lanceolatis margine ciliato-scabris, caule erecto ramoso glabro.

P. barbatum. Linn. Sp. Pl. i. 518. Meisn. Mon. 80. Meisn. in Wall. 56.

Stem erect, hollow, branched, smooth. *Leaves* lanceolate, their margins rough, with rather long scabrous hairs pointing forwards; the nerves beneath, particularly the midrib and a narrow space on the margins of of their upper side, scabrous, subsessile. *Stipules* rather lax above, truncate, their numerous nerves running out into very long and stiff setose points, slightly hairy, the hairs adpressed. *Flowers* in small rather lax stalked twin spikes; bracteæ somewhat distant, turbinate, rather long, fringed with long stiff setose points, 1—4-flowered, flowers 5-fid, "6—8-androus" semitrigynous; pedicels jointed just below the flower. *Fruit* triquetrous, the angles rather blunt, the faces ovate, smooth, and shining.

Saharunpore, near water during the rains, and in the hills in June.

11. P. scabrinervium.

Spicis pedunculatis geminatis subcymosis strictis laxis pedunculis longioribus, bracteis acutis eglandulosis glabris 3—4-floris pedicellis subæqualibus, floribus 6-andris semidigynis, calyce 4-fido eglanduloso, staminibus inclusis, achenio lenticulari lævi nitido, pedunculis glandulosis, ochreis glabris non ciliatis, foliis lanceolatis glandulis flavis numerosissimis suprà et subtùs notatis glabris margine costâque scabroso-pilosis, caule erecto ramoso in parte superiori glanduloso.

P. scabrinervium. Royle MSS.

Stem erect, round, much branched, the branches, upper part of stem, and peduncles covered with minute very short stalked glands. *Leaves* lanceolate, with very numerous minute glandular spots upon both surfaces, glabrous, with the exception of a small space next to the margin above and both sides of the midrib, which are covered with very short stiff hairs. *Stipules* moderate, glabrous. *Flowers* in rather short lax spikes,

placed generally 2 together, and aggregated at the summit of the stem in an imperfectly cymose manner; bracteæ acute, glabrous, not glandular, inclosing several flowers; flowers 4-fid, the segments blunt, 6-androus, semi-2-gynous, the pedicels jointed just below the flower. *Fruit* lenticular, the faces round and acute, smooth, shining.

Mussooree in August; and valleys in the hills during the rains.

12. P. simlense.

Spicis paniculatis pedunculatis ovato-oblongis multifloris, pedunculis glandulosis, bracteis turbinato-infundibuliformibus parvis 2—3-floris pedicellis æqualibus, floribus 4-fidis 6-andris semi-2-gynis, achenii lenticulari calyce absconditi faciebus planis nitidis minutissimè granulatis, ochreis cylindricis muticis glabris, foliis lanceolatis costâ setoso-scabrâ exceptâ glabris margine scabro-ciliatis, caule erecto subsimplici fistuloso glabro in parte superiori glanduloso.

P. simlense. Royle MSS.

Stem erect, nearly leafless above, branched only near to the top, hollow, glabrous below, the upper part, the branches, and the peduncles covered with minute stalked glands. *Leaves* lanceolate, acute at both ends, glabrous, with the exception of the midrib, which is covered with minute scabrous hairs, the margin fringed with small scabrous hairs pointing forwards, narrowed below into a very short and slightly winged stalk. *Stipules* rather long, cylindrical, glabrous, bluntly and transversely truncate. *Flowers* in oblong-ovate dense many-flowered stalked and panicled spikes, the bracteæ obliquely funnel-shaped, glabrous, small, 2- or 3-flowered, about equal to the pedicels, which are jointed just below the flower; flowers 4-fid, the segments blunt; stamens 6, about equal to the calyx; style deeply bifid. *Fruit* lenticular, compressed, its faces orbicular, slightly acute, shining, and very minutely granulated.

Simla in August.

13. P. glabrum. *Willd.*

" Spicis paniculatis strictis continuis laxè cylindricis elongatis multifloris,

bracteis subimbricatis muticis, pedicellis exsertis, floribus 6-rariùs 7-andris, semi-2- vel 3-gynis, calyce 5-fido, achenii lenticularis, rariùs triquetri, faciebus convexis tenerrimè punctatis nitidis, ochreis muticis superioribus internodia longè superantibus, foliis lanceolatis glanduloso-punctatis, caule erecto subsimplici, omnibus plantæ partibus glaberrimis et, præter folia, eglandulosis."

" β. glandulosissimum. *Meisn.* Foliis, maximè subtùs, punctis glandulosis fuscis subimmersis densissimè conspersis, pedunculis interdum apice obsoletè glanduliferis." *Meisn.*

P. glabrum. Willd. Sp. Pl. ii. 447. Meisn. Mon. 78. Meisn. in Wall. 57.

Stem erect, branched, glabrous. *Leaves* broadly lanceolate, acute, glabrous, covered with minute immersed glandular spots, particularly on the under side, slightly stalked. *Stipules* long, surpassing the upper internodes truncate, not ciliated, glabrous, *Flowers* in rather long densely-flowered somewhat panicled and shortly-stalked spikes; bracteæ turbinate, glabrous, rugose, not ciliated, 2—3-flowered; flowers 5-fid, usually 6- or 7-, but sometimes 8-androus, semi-2- or 3-gynous; pedicels jointed just below the flower. *Fruit* lenticular, the faces convex, orbicular and acute, very minutely punctate, shining.

The variety α. obscurum, *Meisn.* does not occur amongst Professor Royle's specimens.

Saharunpore, near water during the rains.

14. P. Donii. *Meisn.*

" Spicis subgeminatis paniculatisve longis filiformibus flaccidis interruptis, bracteis arctis longè remotis setoso-ciliatis sub-1-floris, pedicellis exsertis, floribus 8-andris semi-3-gynis, achenio triquetro faciebus" lævibus opacis, " calyce 5-fido subimpunctato, ochreis laxis adpressè pilosis longè ciliatis, foliis lanceolatis oblongis acuminatis subtus hispidulis margine ciliatis, caule basi radicante adscendente ramoso." *Meisn.*

P. Donii. Meisn. in Wall. iii. 57.

α tenerum. *Meisn.* " Omnibus partibus flaccidis, caule decumbente pauci-ramoso eglanduloso glabro, foliis utrinque æqualiter attenuatis lætè viri-

dibus glabriusculis subtùs in nervis tantùm parcè hispidulis margine molliter ciliatis, spicis raris." *Meisn.*

P. Posumbu. Don, Prod. 71. Meisn. Mon. 73.

Stem smooth, glabrous, slender, hollow, decumbent, rooting, the extremities ascending, branched. *Leaves* broadly lanceolate, equally attenuated at both ends, acute, glabrous, with the exception of the midrib beneath, which is covered with adpressed hairs, the margin ciliated with minute hairs pointing forwards, both surfaces covered with minute prominent points, sometimes very shortly stalked, but more commonly sessile. *Stipules* moderate, with numerous adpressed hairs, fringed with the long stiff setose points of the excurrent nerves. *Flowers* small, in slender few-flowered lax spikes, commonly 2 together; the bracteæ small, slender, and fringed with long stiff setose points, about 2-flowered, the lowest bractea very distant from the next; flowers 5-fid, 8-androus, semi-3-gynous; pedicels jointed just below the flower. *Fruit* 3-quetrous, its faces broadly ovate and acute, smooth but opake.

Mussooree, in August.

Sect. 4. Cephalophilon. *Meisn.*

Subsect. 1. *Didymocephalon.* Meisn.

15. P. filicaule. *Wall.*

"Capitulis exiguis foliis 1—3 suffultis subsessilibus solitariis geminisque, bracteis paleaceis inconspicuis, floribus 8-andris semitrigynis, achenio triquetro calycem subsuperante angulis acutiusculis faciebus nitidulis tenerrimè puncticulatis, calyce profundè 5-fido patulo, ochreis brevibus laxis foliisque utrinque depressè pilosis ciliatis, caule debili simplici glabro." *Meisn.*

P. filicaule. Meisn. in Wall. iii. 59.

β. extenuatum. *Meisn.* "Caule pedali simplicissimo filiformi strigis exiguis reflexo-adpressis parcè asperulo apice sæpiùs bifido, foliis parvis ovatis rariùs oblongis basi rotundatis aut abruptè in petiolum brevem attenuatis." *Meisn.*

P. filicaule, β. extenuatum. Meisn. in Wall. iii. 59.

Stem erect, from 2 or 3 inches to a foot in height, slender, nearly simple, but often forked near the summit, bearing scattered hairs pointing downwards, the internodes long. *Leaves* small, ovate or oblong, on short stalks, hairy on both sides, not ciliated. *Stipules* short, lax, hairy. *Flowers* small, in small few-flowered, mostly sessile and solitary heads, which are surrounded by 2 or 3 small leaves; stamens 8; stigmas 3, nearly sessile; bracteæ minute, paleaceous; pedicels very short and jointed just below the flower. *Fruit* 3-angular, longer than the perianth, shining, but very minutely punctured, pale brown.

In conformity with the views of Professor Meisner I have referred this plant to the present section, with the characters of which it does not exactly accord. See Meisn. in Wall. iii. 59. The varieties *α. cæspitosum* and *γ. alpestre* of Meisn. do not occur among Professor Royle's specimens.

This plant has exactly the habit of *Kœnigia islandica.*

Seran.

16. P. punctatum. *Don.*

Capitulis parvis terminalibus axillaribusque solitariis vel rarius geminatis semitrigynis, achenio triquetro calyci adglutinato faciebus ellipticis acuminatis granulatis opacis, calyce 5-fido, ochreis laxis obtusis hispidis non ciliatis, foliis ovatis acutis in petiolum decurrentibus glabris antrorsùm aculeato-serrulatis subtùs glanduloso-punctatis: superioribus sessilibus amplexicaulibus, caule glabro.

P. punctatum. Don, Prod. 72.

P. perforatum. Meisn. in Wall. iii. 59.

Stem erect, 5 or 6 inches high, solitary, smooth, glabrous, nearly simple. *Root* fibrous. *Leaves* ovate, acute, narrowing into a rather long winged petiole, the upper ones sessile and subamplexicaul, glabrous, the margins fringed with minute spinous hairs pointing forwards, and having numerous minute glands upon the under surface. *Stipules* brown, rather short, blunt, obliquely truncate, hairy below. *Flowers* small, 5-sepalous, 8-androus; style 1, long and trifid above; bracteæ large, ovate, pointed, glandular, as long or longer than the flower; the heads small, terminal

and axillary, solitary, or sometimes 2 together, one of which is nearly sessile. *Fruit* triangular, covered by the subagglutinated calyx, its faces elliptical, pointed, granulated and opake.

Nearly related to *P. humile*, Meisn. (*microcephalum*, Don), but differs from it by having only one nearly simple stem from a fibrous root; the flowers 8-androus, the fruit 3-angular, the leaves glabrous, and the bracteæ glandular. It agrees with *P. perforatum*, Don, in all respects, except by not having glands at the base of its stipules.

Mussooree.

17. P. nepalense. *Meisn.*

"Capitulis folio sessili cordato suffultis, pedunculis geminis, bracteis subscariosis ochreisque muticis glabris, floribus 6-andris semidigynis, calycis limbo 4-fido, achenio compresso faciebus convexis eleganter reticulato-scrobiculatis, foliis summis sessilibus oblongis cordato-amplexicaulibus, inferiorum limbo ovato acuminato e basi subcordata in petiolum quasi alatum decurrente auriculato-semiamplexicauli, subtùs glandulis immersis subpellucidis parcè punctato." *Meisn.*

P. nepalense. Meisn. in Wall. iii. 59.

α. glabrum, *Meisn.* "Foliis utrinque glabris, capitulis plerumque distinctè pedunculatis." *Meisn.*

P. nepalense. Meisn. Mon. 84. t. vii. f. 2.

β. scabridum, *Meisn.* "Foliis in nervis subtùs hirtellis margine subciliatis, capitulis sessilibus aut brevissimè pedunculatis." *Meisn.*

Stem erect, glabrous, more or less branched. *Leaves* on the upper part of the stem, cordate-acuminate, sessile, the lower ones subcordate-acute, narrowed suddenly into a broadly-winged petiole, which is auricled and amplexicaul, the under surface of all the leaves marked with numerous pellucid immersed glandular dots; in var. α. they are glabrous; in var. β. the upper surface is covered with scattered hairs, the nerves beneath are hairy, and the margins are fringed with minute spinous hairs. *Stipules* rather long, blunt, glabrous, with a few hairs at their base. *Flowers*

small, 4-sepalous, 6-androus, semi-trigynous, in rather large heads which are two together and usually slightly stalked; the peduncles bearing stalked glands; bracteæ lanceolate, acute, with a pale white margin, and slightly rough and glandular. *Fruit* compressed, the faces convex, orbicular and acute, beautifully covered with minute reticulations, leaving deep pits between; the calyx is not agglutinated to the fruit, as is usual in this section.

The two varieties are very closely connected, some specimens being almost exactly intermediate.

Mussooree, during the rains.

18. P. sphærocephalum. *Wall.*

"Capitulis solitariis longè pedunculatis rariùs geminis altero subsessili, bracteis paleaceis acutis muticis, floribus 6-andris semitrigynis, calyce magno 5-fido, ochreis muticis, foliis ovatis acuminatis è basi subcordata in petiolum obsoletè alatum basi nudum decurrentibus, impunctatis margine ciliatis subtùs in nervis parcè hispidulis, caule repente ramis ascendentibus glabris."—*Meisn.*

P. sphærocephalum. Meisn. in Wall. iii. 60.

Stem procumbent, rooting, woody, the branches upright, glabrous. *Leaves* all stalked, cordate, acute, glabrous, fringed with minute spinous teeth, pointing forwards, the petioles longish, slightly winged, without auricles. *Stipules* blunt, entire, slightly hairy. *Flowers* 5-sepalous, 6-androus, semitrigynous, with paleaceous acute bracteæ, in rather large and solitary heads upon very long peduncles which are glabrous below and glandular-hispid in their upper part. *Fruit* too young for description.

Meeroo.

19. P. capitatum. *Don.*

"Capitulis compactis, pedunculis geminatis inæqualibus sæpe solitariis, bracteis paleaceis acutis muticis, floribus 8-andris semitrigynis, achenii triquetri faciebus obsoletè granulatis, ochreis brevi-ciliatis, foliis ovatis vel ellipticis subacutis, petiolo brevissimo biauriculato, caule repente sub-

lignoso ramoso cum ochreis foliisque pube purpurascente hispidulo."—*Meisn.*

P. capitatum. Don, Prod. 73. Meisn. Mon. 82.

P. repens. Meisn. in Wall. 60.

Stem procumbent, rooting, woody, hispid, reddish. *Leaves* ovate or elliptical, acute, more or less downy on both sides, ciliated, the petioles very short, with 2 auricles which are very often fugacious. *Stipules* blunt, more or less hairy, ciliated. *Flowers* small, 5-sepalous, 8-androus, semitrigynous, with paleaceous acute bracteæ, in small compact heads, mostly two together, one of them often nearly sessile. *Fruit* trigonous, the faces ovate-acute, opake, and very minutely granulated, the calyx slightly agglutinated to the fruit.

Mutrogh and Hills in May.

20. P. sinuatum.

Capitulis solitariis, pedunculis glabris, bracteis ovatis obtusis, floribus 5-andris semitrigynis laciniis obtusis, achenio triquetro, ochreis glabris vel parcè pilosis, foliis lyratis lobo terminali rhomboideo, petiolo basi biauriculato, caule ramoso.

P. sinuatum. Royle MSS.

Stem procumbent, branched, striated, glabrous, reddish, the internodes very long. *Leaves* glabrous, runcinate, the terminal lobe, the largest rhomboid, or approaching to triangular acute, and about one inch both in length and width, the lateral lobes about three upon each side blunt, the auricles small and blunt. *Stipules* obtuse, glabrous, or very slightly hairy. *Flowers* in dense globose heads upon longish stalks, segments of the calyx 5, obtuse and rounded. rather longer than the 5 stamens, subtrigynous, the bracteæ ovate obtuse. *Fruit* 3-gonous, the angles rounded, the faces very convex and shining.

This is a most interesting species, *P. runcinatum*, Ham., having been the only plant belonging to this genus known to have runcinate leaves. Our plant may be distinguished from *P. runcinatum*, which is fully described by Meisner in Wall. Plant. Asiat. Rar. iii. 60, by its much smaller size ; the terminal lobe

of the leaves in that species is 4½ inches long and 3 inches broad. That plant has the heads two together, the peduncles hairy, the flowers 6—8-androus, the bracteæ and segments of the calyx acute, and the stipules hairy.

Rogee in Kunawur.

Subsect. *Corymbocephalon.* Meisn.

21. P. chinense. *Linn.*

"Octandrum semitrigynum, corymbis simplicibus paniculatisve, pedunculis scabriusculis, bracteolis foliaceis cordatis suffultis, foliis subcoriaceis ovatis vel oblongis acuminatis basi attenuatis cordatisve, plùs minùs pellucido-punctatis, petiolis brevibus basi appendice foliaceo reniformi subdeciduo utrinque auriculatis, caule suffruticoso erecto ramoso glabro." —*Meisn.*

P. chinense. Linn. Sp. Pl. I. 520. Meisn. in Wall. iii. 60.

α. Thunbergianum. *Meisn.*

P. chinense. Meisn. Mon. 60.

Stem erect, smooth, striated, branched. *Leaves* ovate and acuminate, rounded and slightly cordate at their base, the margin obsoletely crenulated and crisped, glabrous, the nerves beneath being sometimes downy, the petioles short, with 2 often very fugacious reniform auricles at their base. *Stipules* semicylindrical, very long, lax, white, often torn, glabrous, with numerous parallel nerves, their base glandular. *Flowers* white, in small heads aggregated in a corymbose manner, 5-sepalous, the segments acute; 8-androus, semitrigynous; the bracteæ paleaceous, about equal to the flowers; the peduncles covered with minute glandular pubescence, and a large white reniform appendage at each subdivision. *Fruit* about ½ the length of the calyx, triquetrous, the faces ovate-lanceolate and granulated.

Bhudraj.

γ. brachiatum. *Meisn.?*

P. patens Don, Prod. 73. Meisn. Mon. 60.

Stem procumbent. *Leaves* ovate-cordate, the nerves hairy beneath, the mar-

gins slightly recurved, crenulated and crisped, no auricles upon our specimens. *Stipules* with fewer nerves than in the preceding variety. *Heads* fewer in number, but forming small corymbs, the bracteæ shorter; the peduncles hispid. *Fruit* the same as in var. α. but the faces nearly triangular.

This is *P. patens,* Don, which Meisner refers to his var. γ. but with which our plant does not exactly agree.

Sect. 5. Aconogonon. *Meisn.*

22. P. tortuosum. *Don.*

Paniculis condensatis, bracteis unifloris, pedicellis erectis longioribus, calycis laciniis obtusis inæqualibus glabris 3 interioribus orbiculatis 2 exterioribus ovalibus angustioribus, ochreis internodio dimidio brevioribus, foliis sessilibus orbiculari-ovalibus sericeis, caule ramoso fruticoso cum ramis pedunculis bracteis ochreisque piloso-sericeis.

P. tortuosum. Don, Prod. 71.

Stem round, ribbed, woody, much branched, solid, covered with woolly hair, the internodes long. *Leaves* round or ovate, 1—1½ inches long, silky, particularly underneath, ciliated, sessile. *Stipules* lax, torn, hairy, not half so long as the internodes. *Flowers* in small dense panicles, the bracteæ longer than the pedicels, hairy and 1-flowered, flowers 8-androus, 3-gynous; the 3 interior segments orbicular, 2 exterior oval and blunt; pedicels without the usual joint. *Fruit* in too young a state for description.

Lippa in Kunawur, Kherang Pass, 22 July. R. Inglis, Esq.

23. P. Hagei.

Paniculi ramis subsimplicibus aphyllis, bracteis 3—6-floris pedicellos erectos subæquantibus, calycis laciniis rotundato-ovalibus obtusis glabris 2 exterioribus angustioribus, ochreis petiolo longioribus internodio brevioribus, foliis lanceolatis apice lineari-attenuatis subtùs lanato-velutinis suprà pubescentibus, caule erecto ramoso striato cum ramis pedunculis ochreisque pilosis.

P. Hagei. Royle MSS.

Stem ribbed, erect, suffruticose, alternately branched, hollow, scabrose-pilose, the internodes long. *Leaves* lanceolate, prolonged into a linear point, silky beneath, and downy above, ciliated, on very short petioles. *Stipules* long, lax, torn, hairy, shorter than the internodes, but much longer than the petioles. *Flowers* in large leafless panicles, the branches of which are nearly simple; the bracteæ about equal to the erect pedicels, 3—6-flowered, the flowers 8-androus trigynous, their segments roundish, ovate, blunt, the 2 exterior ones smaller; the pedicels jointed at a short distance below the flower. *Fruit* castaneous, triangular, about $\frac{1}{3}$ longer than the calyx, very minutely punctured.

Nagkanda.

24. P. polystachyum. *Wall.*

" Paniculis subsimplicibus, racemis folio suffultis pedunculatis discretis gracilibus, bracteis 1—2-floris, pedicellis patulis vel nutantibus bracteâ triplo longioribus, calycis magni laciniis obtusis inæqualibus, interioribus 3-orbicularibus exterioribus 2 ovalibus dimidio minoribus, ochreis petiolo internodioque longioribus, foliis oblongis longè acuminatis, caule fruticoso."—*Meisn.*

P. polystachyum. Meisn. in Wall. iii. 61.

α. glabrum. *Meisn.* " Omnibus partibus glaberrimis."

β. pubescens. *Meisn.* " Caule pedunculis ochreis bracteis petiolisque puberulis vel pilosis, foliis suprà glabris subtùs velutinis."—*Meisn.*

Stem woody, branched, solid, glabrous, the internodes short. *Leaves* oblong, pointed, glabrous, with the nerves minutely downy beneath, ciliated, the petioles very short, and slightly winged. *Stipules* very long, nearly entire, much longer than the internodes, nearly glabrous, with numerous strong prominent slightly hairy ribs. *Flowers* in large slightly-leafy panicles, the branches of which are nearly simple and slightly hairy, the bracteæ $\frac{1}{2}$ or $\frac{2}{3}$ shorter than the patent or even recurved pedicels, which are apparently jointed very near to the flower, about 2-flowered, flowers 8-androus, trigynous, large, the 3 interior segments roundish, the exterior much narrower and ovate. *Fruit* too young for description.

Var. β. *Stem* downy. *Leaves* covered both above and below with minute hairs, which are far more numerous upon the under sides. *Stipules* rather downy, particularly on the nerves; branches of the panicle and the bracteæ downy.

Nagkanda and Cashmere during the rains.

25. P. rumicifolium.

Paniculis subsimplicibus, bracteis basi pilosis unifloris pedicellis brevioribus, calycis laciniis obovatis obtusis æqualibus, ochreis internodio dimidio brevioribus petiolo longioribus pilosis, foliis cordatis ovatisve pilosis margine undulato, caule erecto striato.

P. rumicifolium. Royle MSS.

α. ovatum. Foliis ovatis subtùs pilosis, caule glabro.

β. cordatum. Foliis cordatis suprà et subtùs hirsutis, caule hirsuto.

Stem erect, striated, herbaceous, slightly branched, hollow, glabrous, the internodes very long. *Leaves* ovate, very large, their margins undulated and ciliated, hairy beneath, nearly glabrous above, petioles short. *Stipules* long, lax, torn, their nerves hairy, and furnished with a thick fringe of hairs at their base, not more than half the length of the internodes, but longer than the petioles. *Flowers* in large panicles, the branches of which are nearly simple; bracteæ shorter than the pedicels, one-flowered, their base hairy; flowers 8-androus, 3-gynous, their segments equal, obovate and blunt. *Fruit* trigonous, very young on our specimens.

Var. β. *Stem* covered with hairs pointing downwards. *Leaves* cordate, much smaller than in var. α. and not so wavy, equally covered on both sides with short hairs. *Stipules* much more hairy.

Kunawur.

Sect. 6. Tiniaria. *Meisn.*

26. P. Convolvulus. *Linn.*

Floribus racemosis vel axillaribus parvis, pedicellis sub flore articulatis fructiferis calyce non alato brevioribus, achenii faciebus ovato-acutis granulato-striatis opacis, caule volubili ramoso.

P. Convolvulus. Auctorum.

Differs from the European plant only by having the faces of the fruit usually concave.

In this plant the usual joint in the pedicels is placed quite close to the flower; in *P. dumetorum* the joint is very near the base of the pedicel, i. e. the base of the flower is prolonged so as apparently to form the greater part of the footstalk; in *P. pterocarpum* the joint is placed at about the middle.

Leeo in Kunawur.

27. P. pterocarpum. *Wall.*

" Floribus 3—5 fasciculato-axillaribus, nonnunquam in racemos axillares subsimplices breves paucifloros congestis, pedicellis filiformibus fructiferis deflexis calycem magnum alatum æquantibus, achenii faciebus ellipticis granulato-striatis, caule scandente ramoso."—*Meisn.*

P. pterocarpum. Meisn. in Wall. iii. 62.

Stem twining, branched, with scabrous ribs. *Leaves* stalked, cordate, with a lengthened acute point. *Stipules* short, blunt. *Flowers* in rather small axillary racemes, or 2 or 3 together in the axils of the upper leaves, the segments of the calyx blunt and winged, pedicels elongated; when in fruit recurved and jointed about the middle. *Fruit* triangular, its faces elliptical, acute at both ends, its angles blunt, opake, minutely granulated throughout, quite covered by the enlarged calyx, each segment of which is very broadly winged at its back.

Mussooree, &c. in the Hills.

Sect. 7. Avicularia. *Meisn.*

28. P. herniarioides. *Delile.*

" Floribus ternis parvis 8-andris, pedicellis calycis longitudine, calycis patuli laciniis planis obtusis, achenii acutanguli faciebus nitidis apice obsoletè punctato-striatis, ochreis brevissimis, foliis sessilibus linearibus obtusis 1-nerviis, caulibus herbaceis procumbentibus basi ramosis."—*Meisn.*

P. herniarioides. Meisn. in Wall. iii. 62.

β. prostratum. *Meisn.* " Caulibus duris crassiusculis divaricato-ramosissimis adpressè procumbentibus, internodiis contractis, foliis ovali-linearibus

acutiusculis, margine revoluto nervoque subtùs prominente, rameis internodia superantibus, ochreis flavicantibus densè lacero-ciliatis."—*Meisn.*

P. prostratum. Roxb. (fide Meisn.).

P. Dryandri. Meisn. Mon. 88.

Stem prostrate, branched, striated, smooth, the internodes as long or longer than the leaves, except in the younger branches. *Leaves* narrowly obovate, often linear, acuminate, sessile, their margins reflexed, and the nerve very prominent upon the under side. *Stipules* yellowish white, short, torn, with a few faintly-marked nerves. *Flowers* axillary, 2 or 3 together, minute; pedicels as long or longer than the flowers, and jointed at about its middle. *Fruit* included in the calyx, trigonous; the faces ovate, smooth and shining, obsoletely punctate-striate near to the apex, and with a short striated stalk.

Saharunpore, in April.

29. P. aviculare. *Linn.* ?

Floribus axillaribus parvis, pedicellis brevibus, achenio triquetro granulato-striato perigonio subæquali, ochreis lanceolatis integris, foliis elliptico-lanceolatis minutissimè serratis, caule striato lævi.

Stem prostrate, branched, much striated, smooth, the internodes long, often exceeding the leaves. *Leaves* elliptic-lanceolate, very minutely serrate, shortly stalked or sessile. *Stipules* white, lanceolate, long, but shorter than the internodes, entire, at length torn, with few unbranched brown nerves. *Flowers* axillary, small, upon short pedicels, which are jointed just below the flower. *Fruit* small, triquetrous, equal to, or but little longer, than the calyx, the faces triangularly ovate, acute, granulate-striate.

This plant is so nearly related to *P. aviculare,* that I have not ventured to give it as a distinct species, although it was so considered by Professor Royle. It differs in having nearly all its leaves shortly stalked, and its fruit generally rather longer than the calyx.

In the same paper with this plant there is a single specimen, without flowers, resembling this plant in all points except the stipules, which are long,

torn, and having very numerous parallel brown, mostly unbranched nerves. It is supposed by Professor Royle to be part of the same plant as those which I have considered *P. aviculare.* Should that prove to be the fact, it will go far to destroy several species in this genus, by showing the uncertainty of characters drawn from the stipules.

Saharunpore.

30. P. Roylii.

Floribus axillaribus parvis pedicello brevissimo, achenio trigono granulato-striato calyci æquali, ochreis acutis lobatis haud laceris: venis 2 obsoletis, foliis lineari-lanceolatis acutis integris punctis glandulosis numerosissimis, caule 3—4-angulato: angulis scabris.

Stem prostrate, perennial, branched, with 3 or 4 scabrous angles. *Leaves* linear-lanceolate, acute, entire, covered both above and below with pellucid glandular dots. *Stipules* rather short, acute, lobed, but scarcely torn, with two short nerves. *Flowers* axillary, small, almost sessile, the pedicels jointed just below the flower; the internodes so much shortened at the extremities of the branches as to give the appearance of a spiked inflorescence. *Fruit* small, 3-gonous, equal to the calyx; the faces triangular-ovate, acute, granulate-striate.

Theog and Phagoo, in June.

31. P. mucronatum.

Floribus axillaribus parvis sessilibus, achenio trigono lævi, ochreis ovatis acutis laceris internodiis longioribus nervis nullis, foliis lanceolato-linearibus longè mucronatis marginibus recurvis, caule pubescenti lignoso.

P. mucronatum. Royle MSS.

Stem prostrate, woody, branched, pubescent, the internodes very short. *Leaves* sessile, linear-lanceolate, their margins reflexed, the midrib running out into a long pellucid subulate point. *Stipules* white, longer than the internodes, (very rarely shorter,) acute, torn, without any nerves. *Flowers* axillary, small and sessile. *Fruit* trigonous, smooth, very young on my specimens.

Chango in Kunawur, in August.

32. P. recumbens.

Floribus axillaribus parvis, pedicello brevi, achenio trigono lævi nitido angulis rotundatis segmentis carinatis calycis clausi tecto, ochreis lanceolatis acutis demùm laceris: nervis 2 excurrentibus, foliis ovatis brevi-petiolatis margine nervisque subtùs scabris.

P. recumbens. Royle MSS.

Stem woody, prostrate, branched, ribbed, scabrous, the internodes short, but longer than in *P. confertum.* *Leaves* shortly stalked, ovate, mostly acute, their margins and the under side of the branched midrib scabrous. *Stipules* white, shorter than the internodes, except upon the youngest shoots, lanceolate, acute, at length torn, with two long stout excurrent nerves. *Flowers* axillary, small, oblong, on short stalks, jointed just below the flower. *Fruit* small, 3-gonous, smooth and shining, the faces ovate, the angles blunt, covered by the scarcely enlarged closed calyx, which it equals in length.

Mussooree, August.

33. P. confertum.

Floribus axillaribus parvis globosis, pedicello brevi, achenio compresso trigonove lævi nitido segmentis non carinatis calycis campanulati tecto, ochreis lanceolatis acutis demùm laceris nervis abbreviatis, foliis oblongis 1-nerviis brevi-petiolatis margine nervoque subtùs scabris.

P. confertum. Royle MSS.

Stem prostrate, branched, scabrous, the internodes short. *Leaves* oblong, bluntish, scabrous on the margin and under side of their single nerve, narrowed into a short stalk. *Stipules* white, longer than the internodes, except upon the oldest stems, lanceolate, acute, at length torn, with few nerves, which scarcely reach more than half their length. *Flowers* axillary, small, nearly globose, on short stalks, jointed just below the flower. *Fruit* small, either compressed or trigonous, smooth and shining; the faces ovate, the angles blunt, shorter than the enlarged campanulate calyx, the segments of which are not keeled at the back; the pedicels about as long as the enlarged and winged calyx.

Nearly related to the preceding species, but clearly distinguished by the structure of the stipules, and the calyx spreading when in fruit, not closed, nor keeled as in that species.

Lippa in Kunawur.

Fagopyrum. *Gærtn.*

1. F. rotundatum.

Floribus parvis paniculato-racemosis, achenio trigono angulis rotundatis in parte superiori carinatis calyce 4—5-plò longiore faciebus oblongo-ovatis rugosis, foliis triangulari-hastatis paulò longioribus quàm latis petiolatis, caule erecto.

Annual. *Stem* upright, hollow, slightly angular, downy on the side next to the leaves. *Leaves* stalked, triangular, hastate, rather longer than broad, their angles acute, and their nerves downy on both sides, the lower ones upon long stalks, downy above, the upper ones nearly sessile. *Stipules* short, with numerous simple nerves, and having two points on the side next to the leaf, between which they are divided nearly to their base. *Flowers* in alternate axillary panicled racemes, small, their pedicels not jointed. *Fruit* oblong-ovate, trigonous, the angles obtusely rounded and slightly keeled in their upper half, rugose, with a few longitudinal striæ on the mesial line of each face, 4 or 5 times as long as the calyx.

This plant is distinguished at once from all its congeners by attending to the form of its fruit.

Cultivated in the hills for food. Cheenee in Kunawur, September 8, during the rains.

2. F. esculentum. *Mœnch.*

Floribus paniculatis longè pedicellatis, achenio trigono angulis carinatis integris calyce obtuso duplò longiore faciebus ovato-triangularibus vel -lanceolatis, foliis hastato- vel cordato-triangularibus petiolatis superioribus sessilibus, caule erecto.

F. esculentum. Mœnch. Meth. 290. Meisn. in Wall. iii. 63.
Polygonum Fagopyrum. Linn. Sp. Pl. i. 522. Meisn. Mon. 61.

Stem upright, hollow, angular, downy, particularly on the side next to the leaves. *Leaves* stalked, the upper ones sessile, hastate- or cordate-triangular, the lower angles bluntish, the nerves slightly downy. *Stipules* short, with few simple nerves, bluntly pointed externally. *Flowers* in terminal and axillary long-stalked panicles, sometimes lax and very few flowered, in others condensed and many-flowered, the pedicels not jointed. *Fruit* with ovate-triangular or lanceolate faces, often slightly concave, longer than broad, and transversely marked with very minute striæ, trigonous, the angles more or less acutely keeled, twice as long as the obtuse calyx.

I have not been able to detect the usual joint in the pedicels of either this species, *F. emarginatum*, or *F. rotundatum*, and am inclined to think that the flowers in all three are really sessile, the apparent pedicel being only the prolonged base of the calyx. The proportion between the length and breadth of the fruit appears to be very variable in this species; in some instances the faces are nearly as broad as long, and in others they are so much lengthened as to become truly lanceolate.

Cultivated in the hills for food.

3. F. emarginatum.

Floribus paniculatis parvis, pedicello elongato, achenio trigono angulis alatis integris calyce obtuso duplò longiore faciebus ovatis longioribus quàm latis, foliis petiolatis triangularibus acutis angulis inferioribus rotundatis.
P. emarginatum. Roth.? Cat. Bot. i. 48. Don ?, Prod. 73. Meisn.? Mon. 62.
Stem upright, hollow, striated, downy. *Leaves* stalked, triangular, the two lower angles rounded, the terminal angle elongated and acute, nerves slightly downy. *Stipules* short, without nerves, blunt. *Panicles* alternate, terminal and axillary, upon long stalks, which are downy above; the flowers small, with long pedicels, which are not jointed; the segments of the calyx blunt. *Fruit* trigonous, the angles winged, with ovate faces, which are longer than broad, smooth and opake.

This differs from *P. emarginatum*, Don, by not having the fruit "apice truncato et emarginato." It differs from Roth's plant by the faces not being "latioribus quàm longis."

Cultivated in the hills for food. Cheenee in Kunawur, September 8.

4. F. cymosum. *Meisn.*

"Paniculis longè pedunculatis subaphyllis dichotomis trifidisve, racemis conjugatis subconfluentibus divaricatis subrecurvis, achenio maturo calyce plus dimidio longiore, angulis acutis integris, faciebus ovato-rhombeis apicem versus attenuatis, foliis inferioribus cordato-triangularibus hastatisve lobis obtusiusculis, supremis oblongo- v. lanceolato-sagittatis, caule orgyali annuo radicibus perennibus stoloniferis." *Meisn.*

F. cymosum. Meisn. in Wall. iii. 63.

P. cymosum. Trevir. in Nov. Act. Nat. Curios. xiii. 177. Meisn. Mon. 94. Reich. Icon. Exot. t. 176.

Stem upright, hollow, striated, downy. *Leaves* stalked, the lower ones cordate-triangular, the lobes slightly pointed, the points themselves rounded, the upper ones nearly sessile, much more triangular, and the angles acute, the highest sessile, lanceolate, sagittate and amplexicaul, all of them slightly downy on both sides, particularly upon the nerves. *Stipules* rather long, blunt, downy. *Panicles* terminal and axillary, on long stalks, forked or trichotomous, consisting of spiked, patent, or slightly recurved racemes, the peduncles downy, the flowers small, the segments of the calyx blunt, the pedicels jointed in the middle. *Fruit* wanting upon our specimens.

Mussooree, and on the road to Cashmere.

V. *Notice of certain* AUSTRALIAN QUADRUPEDS, *belonging to the Order* RODENTIA.

By W. OGILBY, *Esq., M.A., F.R.A.S., F.L.S., &c.*

Read December 5th, 1837.

THE anomalous nature of the indigenous quadrupeds of Australia, the almost exclusive predominance of the Marsupial family in that singular country, and its extreme poverty in the ordinary Monadelphine groups of Mammals, is one of the most curious and interesting facts in modern zoology. Setting aside the bats, which their physical structure renders in a great measure independent of local boundaries, and the Seals and *Cetacea*, which, from the very nature of the element they inhabit, are circumscribed in their geographical range by none of those insuperable restrictions which limit the distribution of ordinary quadrupeds, I am acquainted with only six or seven species of terrestrial Mammals, out of at least sixty already known to inhabit the continent of Australia and its immediate dependencies, which do not belong to Marsupial forms. This fact is in itself sufficiently singular; but our surprise is still further excited when we learn, that, of these six or seven exceptions, all the truly indigenous species belong exclusively to the order *Rodentia*, and that the numerous tribes of *Quadrumana*, *Carnivora*, *Edentata*, *Pachydermata*, and *Ruminantia* are absolutely without any known representatives in that extensive quarter of the globe. Such at least is the result to which our present knowledge of Australian mammalogy conducts us; for, I think, that there are strong grounds for believing that the *Dingo*, or native dog, the only solitary exception which can be adduced against the universality of this position, is not an aboriginal inhabitant of the continent, but a subsequent importation, in all probability contemporary with the primitive settlement of the natives. Many circumstances might be advanced in support of this opinion; the simple fact of his anomaly is itself a strong corroboration of it; and his absence

from the contiguous islands of Tasmania and New Zealand*, inhabited by races of human beings differing in language and origin from the natives of Continental Australia, appears almost to demonstrate his introduction from the north, where he is found in New Guinea, in Timor, in many of the smaller groups scattered throughout the Pacific Ocean, and in all the great islands of the Indian Archipelago. The extirpation of the *Thylacinus Harrisii* and *Dasyurus Ursinus* from the continental portion of Australia, is a strong corroboration of this supposition. It is contrary to all the principles of Zoological philosophy, and to what we already know of the laws which regulate the geographical distribution of animals, to suppose that these species, two of the largest Mammals in that part of the world, should have been originally confined to so small an island as Tasmania, to the exclusion of the neighbouring continent. The more probable theory is, that they were extirpated from the latter locality by the introduction of some more powerful adversary: this could have been no other than the native dog, to whose attacks these two species were more peculiarly exposed, from being the slowest, most cowardly, and least protected animals in the country. The *Wombat*, the *Echidna*, and the *Ornithorhynchus* are indeed more sluggish, but they are less obnoxious to attack on account of their burrowing and aquatic habits; the common Dasyures, Kolas, and Phalangers find security in their powers of climbing trees; and the Kangaroos and Potoroos in speed of foot, or by concealing themselves in clumps of impenetrable brushwood. The *Thylacine* and *Ursine Dasyure* are in reality the only aboriginal inhabitants universally exposed to the attacks of the dog; and their total extirpation from the continental portion of Australia, where he has been long established, and their confinement to the comparatively small island of Tasmania, to which he had never found his way before the colonization of the country, all but demonstrate the recentness of his introduction into the neighbouring continent. But I shall not insist further upon this question, though its bearings upon the history of the origin and migrations of the aborigines of Australia are by no means devoid of importance: my object is to describe two of the indigenous Rodents of that singular continent;

* The dog is at present found in New Zealand, but is believed to have been introduced by the early navigators: in Van Diemen's Land he was absolutely unknown previously to the settlement of the British colonists at Hobart's Town.

and though the imperfect nature of the materials at my disposal enables me rather to excite than satisfy the curiosity which naturally attaches to the subject, I may be permitted to indulge a hope that the present notice will at least attract the attention of future inquirers, and be the means of procuring more detailed and accurate information.

That a vast majority of the terrestrial quadrupeds of Australia belong to the Marsupial family, a group in a great measure peculiar to that locality, and altogether anomalous in relation to the Mammals of other quarters of the globe, is a fact too well known to require further illustration. At the same time, the exceptions to this general rule are much more numerous than has been hitherto suspected: it is true, indeed, that only five, or at most six species of Monadelphine quadrupeds have been hitherto described as indigenous to that extensive continent; but the evidence which I shall produce in the present memoir gives us every reason to anticipate an extension of the number, whilst it establishes the singular and hitherto unlooked-for fact, that these exceptions belong exclusively to the Rodent order. Of the five or six monodelphine species already known to share this common habitat with the Marsupial family, one is the *Dingo*, or native dog, which, as I have observed above, should in all probability be expunged from the catalogue of aboriginal animals; three belong to the extensive and cosmopolite genus *Mus*; and the remaining one, or, perhaps, two species, constitute the genus *Hydromys* of M. Geoffroy St. Hilaire, the only nonmarsupial form hitherto described as peculiar to Australia.

Under these circumstances, the announcement of any addition to the indigenous Rodents of that country becomes in itself a matter of sufficient importance; but the discovery of new forms and genera, either altogether unknown, or hitherto unsuspected to exist in that quarter of the globe, invests the subject with more than ordinary interest, and whilst it enlarges the bounds of science, demonstrates the universality of those inscrutable laws which regulate the geographical distribution of animal life. It is, therefore, with feelings of more than common satisfaction that I present this memoir, however necessarily imperfect, to the notice of the Linnean Society; more especially, as it affords me an opportunity of acknowledging my personal obligations to a gentleman to whom science and his country are equally in-

debted, and who has earned the just tribute of public gratitude by a career of honourable and successful discovery. Whatever is most curious and valuable in the following observations, is mainly due to the liberal and obliging communications of Major Mitchell, Surveyor-General of New South Wales; and if his name occurs less frequently than it ought to do in the course of the following pages, I beg it to be distinctly understood that the circumstance arises entirely from a desire to avoid the too frequent repetition of acknowledgements, which are at all times more easily felt than expressed.

I proceed to the description of the

Genus Conilurus,

a new and interesting form of the Rodent family, with the general characters of which I have long been partially acquainted, though it is only from the communications of Major Mitchell that I am enabled to detail the valuable particulars of its habits and œconomy, which will be found in the sequel. The appellation by which I propose to designate this new genus is compounded of the words οὐρὰ and κόνιλος, (evidently a Greek form of the barbarous term *Coney*,) which occurs in Ælian as the name of the common rabbit, and is intended to express the resemblance which the animal bears to a small rabbit with a long tail. My observations are founded upon the examination of two specimens which have long been in the Society's collection under the name of "the Native Rabbit," and which were formerly brought from New South Wales by the late Mr. George Caley. Both specimens are unfortunately without skulls, so that it is impossible for me at present to establish the characters of the genus upon strictly scientific principles; and I can only deduce from the form of the claws and feet, the quality of the fur, and various minor particulars, confirmed, however, by the testimony of Major Mitchell, that they belong to the Rodent order, and most probably to the extensive and complicated family of *Muridæ*. Like these animals, they have the hind legs considerably longer than the fore, the excess arising principally from the development of the tarsus; four toes on the fore feet and five on the hind, all long, slender, separate, and armed with small weak claws, sharp, and partially compressed on the sides, but scarcely surpassing the extremities of the toes, and totally unadapted to habits of burrowing, except, perhaps, in

very loose friable soil. The toes of the fore feet are placed very nearly on the same line, the two middle, however, being considerably longer than the lateral, and the outer one the shortest of all: on the hind feet, the three middle toes are of equal length, and placed nearly on the same line as to their origin; the two lateral originate some way behind these, one on either side, and though rather shorter, are still sufficiently developed, and armed with claws in all respects similar: the lengthened tarsus, as in the rats and mice, is covered in front with very short, adpressed hairs, and nearly naked on the posterior surface.

These are very much the characters of the Campagnols (*Arvicola*), and Gerbilles (*Meriones*), to the latter of which genera *Conilurus* is more particularly related by the length and development of the posterior members. The pelt likewise is similar, being composed of a fine soft fur, of a uniform quality, but longer in proportion than that of the common rats, and without any intermixture of long silky hairs. Of the form and proportions of the head and teeth it is totally impossible for me to give any satisfactory account; the skulls, as has been already observed, have been removed from both the specimens, and the artist has mounted them in such a manner, by giving one the short round head and large eyes of a young rabbit, and the other the long attenuated snout and small eyes of a rat, as effectually to preclude all rational conjecture upon the subject. In this uncertainty, if I might be permitted to entertain a surmise as to the actual form of the head, I should rather be disposed to consider the first-mentioned specimen as in all probability approaching most nearly to the natural character of the animal; and I am strengthened in this opinion by the name of "Native Rabbit," under which it appears that Mr. Caley brought it from Sydney, as well as by the comparison which Major Mitchell makes of it to that quadruped in the interesting extract which I shall presently give from his Journal. The ears are long, upright and elliptical, not unlike those of the rabbit in form, though rather shorter in proportion, rounded at the points, of a brown colour, and nearly naked both on the anterior and posterior surface; and the tail, which is as long as the body and head together, is of an equal thickness throughout, and everywhere covered with pretty long silky hairs, shaded regularly on either side like the beard of a feather, and giving it a peculiar fringed and flattened appearance, by which

alone the animal might be readily distinguished, in the absence of more important characters.

Such, I regret to say, are the very meagre details which alone I have it in my power to give as to the generic characters of this interesting animal; I have delayed the publication of my observations upon this subject for six years, in hopes of obtaining more definite information; but though these hopes have been hitherto in a great measure indulged in vain, they may perhaps be finally realized through the medium of the present notice.

The only species which has come under my observation is that in the Society's Collection, and which Major Mitchell has identified with the animal found by him during his recent journey into the interior of Australia. From the singularity of its habits, as related in the following interesting extract from that gentleman's Journal, I propose to distinguish it by the specific name of

Conilurus Constructor. *C. subcinereus, ventre albo: auriculis longis, nudis; cauda longissima, marginata.*

The length of this animal from the muzzle to the origin of the tail is ten inches; that of the tail itself nine inches and a half; of the head, from the muzzle to the anterior margin of the ear, two inches and a quarter; of the ear rather better than an inch; of the anterior extremities about two inches; and of the posterior three inches and three quarters, of which the tarsus alone measures an inch and three quarters; the distance between the ears is about three quarters of an inch; the distance between the eyes one inch; and the breadth of the ear three quarters of an inch. These proportions, as far as they relate to the comparative length of the anterior and posterior extremities, are much the same as those of the Common Rabbit, or if anything, the inequality is rather less considerable; on the other hand they scarcely differ from the proportions of the same parts in the *Mus longipes* of Pallas, and other species of the tetrapodal section of the Gerbilles, and we may therefore reasonably infer that the pace and motions of the *Conilurus constructor* are in no respect different from the movements of these animals. The length and separation of the fingers also give it a prehensile power in the hand, which will naturally be turned to purposes of manipulation, such as the handling of

objects, carrying its food to its mouth, &c., and the facility with which it executes such functions is still farther increased by the development of the tarsus, which affords it a secure base to sit upright whilst the hands are employed in these operations.

This species is about the size of a small Rabbit: it has a short, round, and remarkably convex head, large, full, black eyes, directed laterally, and an abundance of long, stiff moustaches, nearly twice the length of the head, and of an uniform black colour. The colour of the body is uniform ashy brown on the upper parts, of a shade not very different from that of the Wild Rabbit, but rather lighter and clearer; the breast, belly, and paws are white; the ears are long, erect and of an oval form, rounded at the extremity, and nearly naked both on the external and internal surface, not unlike those of the Rabbit in appearance, but rather shorter in proportion to the size of the animal. The texture of the fur is long, close, and soft; it is of a beautiful deep ash colour at the base, and throughout three fourths of its length, but is tipped with light brown; and it is this latter shade which gives the general tone of colouring to the upper and outer parts of the body. The tail is as long as the head and body together, slender for the size of the animal, but of an uniform thickness throughout its entire length, and everywhere covered with longish hair, of a dark brown colour above, white beneath, and shaded towards each side so as to give it the appearance of being flattened above, and fringed along the margins; the tip, though not terminated by a white brush, has something of that appearance, from the long white hairs of the under surface projecting over it.

The only information which I can supply with regard to the habits and economy of the *Conilurus constructor*, is contained in the following interesting extract from the Journal of Major Mitchell, who met with the animal in various parts of the interior, and more particularly along the banks of the river Darling, where he informs me that it is not uncommon.

"We had frequently," says this gentleman, "during the course of our travels, remarked large piles of dry sticks and brushwood, each of them enough to make two or three good cart-loads, collected and heaped together in different situations, and evidently designed for some particular purpose. For a long time we imagined them to be the work of the natives, who are in the habit of com-

municating the intelligence of any strange or uncommon event to distant tribes by raising dense columns of smoke in different directions over the face of the country, and we fancied that these were their rude telegraphs, kept ready for immediate use when an occasion occurred to require it. A more minute examination, however, soon convinced us of our error; we found, in fact, that the materials were not thrown promiscuously together, as would naturally have been the case had they been collected by the natives for the purpose of burning, but that each stick and fragment was so curiously intertwined and woven with the rest, that the whole formed a solid compact mass, so firmly bound together, that it was absolutely impossible to remove a part without at the same time moving the whole fabric. Our kangaroo dogs also drew our attention more particularly to the examination of these curious structures, by the constant ardour which they displayed in barking and scratching whenever we fell in with them, thus manifestly intimating that they expected to find something inside. At length we broke several of them open, a work of no small difficulty from the solidity of their structure, and were not a little surprised to find in the interior a small nest occupied by an animal something between a rabbit and a rat, which had constructed this formidable and massive stronghold to protect itself against the attacks of the native dog. For this purpose the little animal chooses some small bush or shrub, as a fixed *point d'appui* to commence its operations; and by gradually working round this, and interlacing the materials of its fortalice, first of all with the growing branches of the centre bush, and afterwards with one another, gradually extends it to the enormous dimensions already specified, and enjoys the reward of its perseverance and ingenuity in subsequent security and repose. This little animal has ears exactly resembling those of a small rabbit, soft, downy wool, and short hind legs, and, but for the tail, might readily pass for a small rabbit."

Something of this constructive faculty is observed among the *Squirrels* and *Tamias*, but in neither of these genera is it developed so perfectly as in the *Conilurus*. Mr. Say, indeed, relates that the *Tamia quadrivittata* makes a nest of the "burrs of *Xanthium*, portions of the upright *Cactus*, small branches of pine trees, and other vegetable productions, sufficient in some instances to fill a cart," but these do not appear to be artificially woven together, as in the

case of the *Conilurus,* and, therefore, cannot be justly compared to the singular structures erected by that animal. I regret my inability to afford any farther information upon this interesting subject; but however imperfect the description which I am at present able to give, it will at least serve to direct the attention of future inquirers towards an animal, no less remarkable for the apparent singularity of its external characters, than for its interesting habits, and the geographical position which it occupies, in common with some of the most anomalous forms of the animal kingdom. From the extreme rarity of this animal in European Museums, as well as from its being unknown to all gentlemen connected with the colony of New South Wales of whom I have inquired concerning it, it must have disappeared from the inhabited parts of the country; and, indeed, it may be easily imagined that a creature of such peculiar habits, would necessarily retire before the advance of population, more rapidly than ordinary quadrupeds.

Genus Dipus.

The discovery of a true Jerboa on the central downs of Australia, is an event of no small interest to the Scientific Zoologist, who occupies himself with the important question of the Geographical distribution of animals. The arid deserts of Asia and Africa, the solitary steppes of Southern Siberia, and the boundless prairies of America, have been long known to be inhabited by numerous species belonging to this or the closely allied genus of *Gerbilles*; in short, wherever extensive and open plains were found to exist, whether in the Old World or in the New, there likewise were found these little two-legged rats, hopping along or running with great velocity upon their hind legs, and appearing as if nature had expressly intended them to occupy such a situation. Australia alone was believed to form an exception to the general rule, in this instance as in so many others: who will undertake to say that the progress of discovery may not destroy its anomalous character in many other instances, as it has done in this?

For the interesting discovery in question we are entirely indebted to Major Mitchell; and I think it only due to the enterprise and ability of that meritorious officer, whose successful researches in the interior of Continental Australia have had the rare merit of enlarging the bounds of science, and at

the same time of increasing the available territory of the country, to commemorate the event by associating it with his name. I therefore propose to distinguish this interesting species by the name of

Dipus Mitchellii. *D. plantis subpentadactylis; corpore supra cinereo-fusco, subtus albido; auriculis magnis; cauda longissima, floccosa.*

This little animal is rather larger than a common mouse, which it is described as closely resembling in the colour and texture of the fur, being of the same pale ashy-brown tinge on the upper and outer parts, and clearer or more greyish ash beneath. The head is thick and short; the muzzle blunt; the upper jaw projecting considerably beyond the lower, and copiously furnished with an abundance of long black moustaches; the eyes are of moderate size; and the ears rather large, erect, rounded at the points, and apparently naked. The fore feet are short, the hind excessively long, as in the rest of the genus, the disparity being equally due to the development both of the tibia and tarsus; the arms, legs, and thighs are covered with fine soft fur, like the rest of the body, but the tarsus and paws are nearly naked, or only covered with very short, adpressed silvery hairs. The tail is considerably longer than the body, naked and scaly towards the origin, but covered, on the terminal half, with long black hairs of a silky quality, which gradually increase in number, and form a middling sized brush at the tip.

The dimensions of this animal, as taken from a figure as large as life, are as follows.

Length from the nose to the origin of the tail	$4\frac{3}{4}$ inches.
——— root of the ear	$1\frac{1}{4}$ inches.
Length of the tail	6 inches.
——— anterior extremities	$\frac{3}{4}$ of an inch.
——— of the tibia	$1\frac{3}{4}$ inches.
——— of the tarsus and toes	$1\frac{1}{2}$ inches.
——— of the ears	$\frac{3}{4}$ of an inch.
Breadth of the ears	$\frac{1}{2}$ an inch.

The anterior extremities appear to have four toes developed, and a small nailless tubercle in place of the thumb, a disposition common not only to other species of Jerboas, but to a great majority of the extensive family of

Muridæ; on the hind feet there are three toes on the same line and of the same length, and at a considerable distance behind these, a well-developed internal toe, furnished with a distinct claw, and apparently a smaller or rudimentary one, without a claw, on the outer side of the tarsus. Of this latter, however, I am by no means certain, for it is difficult to distinguish, in a sketch, like that from which the principal part of this description has been taken, the difference between a rudimentary toe of this nature, and the small fleshy pads usually found on the soles of such animals. If it exist at all, however, the external toe in question must be a mere tubercle; but for my own part, though I have here thought proper to describe the appearance exactly as I have observed it in the sketch, I should rather be inclined to doubt its existence, because rudimentary toes of that description, where they do exist, are generally found on the inner side of the foot, and I do not remember having ever met with a single example of such a clawless tubercle on the outer surface. In either case the character of the toes will readily distinguish the *Dipus Mitchellii* from the rest of its congeners; there is no known Jerboa which has a clawless or tuberculous toe on the hind feet; and the only other species with which it could possibly be confounded, the *Dipus tetradactylus* of Lichtenstein, has the additional toe on the external instead of the internal surface of the tarsus. That species is indicated as an inhabitant of the Libyan desert, where it was found by Drs. Hemprich and Ehrenberg; the five-toed species are all natives of the plains of Central Asia and Southern Siberia, and it is not a little singular that we should find the same type reproduced in the interior of Australia. The *Dipus Mitchellii* was found at Reedy Plains, near the junction of the Murray and the Murrumbidgee, on the northern boundaries of Australia Felix.

But I may be asked for a further justification of the opinion here announced, as to the existence of a true *Dipus* in Australia, founded as this opinion is upon the authority of a mere drawing; and I confess that the question is both just and pertinent. It might, indeed, be suspected, with some show of probability, that since the country is already known to abound in Saltigrade Marsupials, the animal in question may really belong to that form, and be more nearly allied to the Kangaroo rats than to the *Rodentia*. That the animal may eventually turn out to be Marsupial is not impossible; but, inde-

pendently of the express declaration of its discoverer, that it had no pouch, though he had no recollection of the characters of the teeth, I beg leave, in the meantime, to offer the following reasons in support of my belief that it is a true Jerboa. In the first place, the form of the head, the swollen muzzle, covered with hair, and projecting considerably beyond the short under-jaw, are well-known characters of the *Rodentia*, which are not common to the Saltigrade Marsupials; in which, more especially among the smaller sized species, the head is attenuated and flattened sideways, the extremity of the muzzle naked, and the under-jaw nearly of the same length as the upper. Secondly, the character of the tail, naked and scaly throughout the greater part of its length, and terminated by a large pencil of long hair, is unknown among the Saltigrade Marsupials, and universal among the Jerboas. Thirdly, the three middle toes of the hind feet are of the same size, and originate on the same line, a structure likewise characteristic of the Jerboas, whilst the Saltigrade Marsupials, on the contrary, have the lateral toes placed considerably behind the middle, and of much smaller size. Fourthly, there is no known instance of a Saltigrade Marsupial with an additional or accessory toe, placed half-way up the tarsus, as represented in the figure of *Dipus Mitchellii*, though the character is common enough among the Jerboas; and lastly, there is no known instance of a Saltigrade Marsupial which *has not* the two internal toes of the hind feet united, or of a Rodent that *has*. In this last character, as in all the rest, the drawing of *Dipus Mitchellii* perfectly agrees with the true Jerboas, and differs from the Saltigrade Marsupials; so that if it eventually turn out to belong to this latter family, it must possess the characters of an essentially new form, of a genus no less singular than novel. It may be observed, in conclusion, that the fidelity of the figure is unquestionable; Major Mitchell is well known to be a skilful draughtsman; he made his sketch upon the spot when the animal was captured; and not being himself a zoologist, it is utterly impossible that he could have so accurately depicted the characters of the genus *Dipus*, of which he had perhaps never heard, had he not drawn from the model.

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VI. *On the Family* Fulgoridæ, *with a Monograph of the Genus* Fulgora *of Linnæus.* *By* John O. Westwood, *Esq., F.L.S., &c.*

Read November 21st, 1837.

AMONGST the insect tribes, the order *Homoptera* must be admitted to contain the most extraordinarily formed creatures to be met with in this class of beings. In some the thorax is armed with balls and spines, crescents, sabres, and other mimic instruments of war: in others the same part is transformed into a singularly dilated globe, concealing the rest of the body, or swelled out into an enormous casket which would be far too heavy to bear were it not quite hollow. In others again, the head is produced into an elongated and swollen rostrum of the most singular construction, varying in the different species, which is occasionally armed with spines or saws, and sometimes bent over the back. Of the use of these curious modifications it is difficult to form any idea. We are not indeed to suppose that aught has been made in vain; but when we find such an endless variety of form in the same organ, we must be led to conclude either that the use for which it is bestowed upon the creature is always modified in accordance with the modifications in its structure, or that the production of so many extraordinary variations in organs not having a material influence upon the habits of the animals must be considered as a manifestation of Divine power; in which point of view the contemplation of such productions is not without use.

Of these insects some of the most curious are the species of which Linnæus composed his genus *Fulgora*, but which has become so much augmented by the addition of new species as to have been raised to the rank of a separate family, named *Fulgoridæ* by Dr. Leach and *Fulgorellæ* by Latreille. It is in the most conspicuous of these insects composing the modern restricted genus *Fulgora*, that the head exhibits those curious modifications of form already noticed, and to which an additional interest attaches from the circumstance of these insects having long been regarded as possessing the power of emitting a strong light from the anterior produced part of the head. Such

opinion, however, originating in an account given by Madame Merian of the *Fulgora Laternaria*, appears at the present time to be regarded as fabulous, no other traveller of any authority or credit having since observed the least traces of luminosity, although the insect is by no means rare in South America. The reader will find an amusing fictitious discussion upon this subject in the third volume of the Entomological Magazine, wherein the contrary opinion appears to prevail; M. Lacordaire, M. Richard, Dr. Hancock, Dr. Burmeister and M. Guérin, however are in favour of the non-luminosity of these insects, which was also personally confirmed to me by the late lamented Prince Maximilian of Neuwied*.

In the original separation of this group of insects from the great division composing the Linnæan genus *Cicada*, Linnæus appears to have had in view chiefly the form of the head, his characters being "Caput fronte producta, inani. Antennæ infra oculos: articulis 2; exteriore globoso majore. Rostrum inflexum. Pedes gressorii." (*Syst. Nat.* 2, 703.) Nine species were described by Linnæus, all of which are subsequently noticed in this memoir. Fabricius in like manner evidently regarded the structure of the head as of primary importance, since, although his characters are simply "os rostro elongato; vagina 4-articulata, antennæ breves, capitatæ," we find in his detailed description the character "Capitis fronte porrecta, elongata, adscendente, cylindrica, retusa." And amongst the species introduced by him into the genus, we accordingly find species which agree with the true *Fulgoræ* in no other character than that of the form of the head, belonging in fact to a distinct family as subsequently noticed. By Fabricius also and by Latreille other genera were established; being chiefly separated from the Linnæan *Cicadæ*, but having in the majority of their structural characters a nearer relation with *Fulgora*. The chief of these were *Flata*, *Lystra*, *Derbe*, *Delphax*, and *Issus* by Fabricius, and *Pœciloptera*, *Cixius*, and *Asiraca* by Latreille. All these genera were united together into a separate family by Latreille under the name of *Fulgorellæ*, changed by Dr. Leach to *Fulgoridæ*, and from time to time others have been added by more recent authors, as Germar, Guérin, Laporte, Burmeister, Kirby, &c.

* M. Wesmael has recently communicated to the Academy of Brussels, a reassertion of the luminous powers in *F. Laternaria*, on the authority of a friend who had witnessed an insect alive in South America (Ann. Soc. Ent. de France, 1837, p. lxvii.).

In the year 1830, Dr. Germar published a memoir upon these insects in the second volume of Dr. Thon's *Entomologisches Archiv*, in which he gave the following characters of the family, and its distribution into genera.

Fulgorellæ.

Antennæ biarticulatæ, articulo secundo papilloso setigero. Oculi laterales, genis perpendicularibus inserti, earumque margine circumsepti. Ocellum utrinque solitarium aut nullum. Tibiæ posticæ apice spinis ciliatæ, tarsorum articulo 1mo elongato.

I. Margo costalis elytrorum lævis aut irregulariter striatus.

A. Antennæ oculis breviores, capitulo incrassato.

1. Clypeus a fronte disjunctus . . . . *Fulgora.*

2. Clypeus cum fronte conjunctus facie elliptica.

a. Oculis sessilibus.

α. Ocellum utrinque conspicuum . . . . *Flata.*

β. Ocelli nulli.

*. Elytris fornicatis . . . . *Issus.*

**. Elytris perpendiculariter decumbentibus . *Amphiscepa.*

b. Oculis saltem in inferiore parte pedunculatis, clypei margine laterali involutis. . . . . *Lystra.*

B. Antennæ oculos superantes, capitulo cylindrico.

1. Tibiæ posticæ apice appendice gladiiformi instructæ.

a. Capitulum articulo basilari longius . . . . . *Delphax.*

b. Capitulum articulo basilari brevius . . . . . *Asiraca.*

2. Tibiæ posticæ muticæ.

a. Palpis nullis . . . . *Anotia.*

b. Palpis quatuor . . . . *Otiocerus.*

II. Margo costalis elytrorum striis parallelis transversis percussus.

A. Alæ perpendiculariter deflexæ . . . . *Pœciloptera.*

B. Alæ incumbentes . . . . *Ricania.*

By this arrangement nine species only were comprehended in the genus *Fulgora*, several being here first described, so that the major part of the Lin-

nean and Fabrician *Fulgoræ,* including the well-known Chinese species *Fulgora Candelaria*, the European *Fulgora europæa*, &c. were placed in the genus *Flata.* The character, however, upon which this separation was founded cannot be maintained, since in *F. Candelaria* and its allies the separation between the forehead and the clypeus is strongly marked, and even in *F. tenebrosa* the line of separation may be clearly perceived.

M. Guérin in his description of the insects collected in the "Voyage de Belanger," gave another classification of the family, consisting of seventeen genera; amongst which *Flata* and its allies are separated from *Fulgora* and its allies, by the size of the prothorax, which is much narrower than the mesothorax, and deeply notched behind; whereas in the latter the prothorax is "presque aussi large que le mesothorax, et très peu échancré en arrière." This last section consists of the following genera, thus tabularized:

Second joint of the antennæ globose.	Forehead prolonged into a rostrum . .	*Fulgora.*
	Forehead not prolonged	*Eumallia.* (*Phenax*, Germar.)
Second joint of the antennæ oval .	Forehead longitudinal	*Aphæna.* (*Aphana*, Burm.)
	Forehead transverse	*Lystra.*

By this arrangement, the character derived from the produced anterior part of the head is made secondary to that of the form of the antennæ; and consequently we find that some of the species of *Aphana*, (*A. discolor*, *A. fuscata*, Guér., *A. nigro-maculata*, Gray,) have the head produced into a recurved horn, as is also the case with *Fulgora recurva*, which ought also to be considered, according to this arrangement, as an *Aphana.* Burmeister has, however, given another arrangement of these allied genera, which in some degree alters the limits of the genus *Fulgora*, and which is as follows:

a. Front of the head not rostrated.

§ Second joint of the antennæ elongate-ovate.

Forehead broader than long . . . . *Poeocera.*

Forehead longer than broad or quadrate . . . *Aphana.*

§ Second joint of antennæ globular.

Forehead without elevated central carinæ . . . *Lystra.*

Forehead with elevated central carinæ . . . . *Phenax.*
(*Eumallia*, Guér.)

b. Front of the head rostrated . . . . *Fulgora.*

The last-named genus is thus made to comprise not only the old species *F. Laternaria*, *Candelaria*, and their allies, but also *F. recurva*, *tuba*, and *tuberculata*, together with *Flata hæmoptera* of Perty; in which last two species the head cannot be said to be rostrated, and in the first two the rostrum is small and recurved, and the second joint of the antennæ oval, whence they ought not to be separated from *Aphana discolor*, *fuscata*, &c.; although from the general habit of the insects, and even the colouring of the wings, *F. recurva* and its allies as well as *F. platyrhina* are perhaps too closely related to *F. diadema* to warrant their absolute removal from the genus. The species, however, are so closely connected together that it is impossible to draw the line of distinction. Germar has also, in a memoir upon this tribe of insects, published in the fourth number of Silbermann's *Revue Entomologique*, separated *Fulgora europæa*, *hyalinata*, *fenestrata*, &c. under the generic name of *Dictyophora*, with the character, "Elytra apice reticulata, clypeus oblongo-ovatus, caput conico-elevatum." In consequence of this generic name being previously employed, Dr. Burmeister has changed it in the second volume of his "*Handbuch*," p. 159, to *Pseudaphana*.

As restricted above, the genus *Fulgora* may be thus characterized:

Corpus oblongum, subdepressum. *Caput* fronte in rostrum vel tubulum plùs minùsve elongatum, porrectum, (nec recurvum,) productâ; nec conico-elevatum. *Antennæ* articulo 2ndo globoso, hemispherico, granuloso, setâ e medio ejus apicis exeunte, articulo minutissimo ad basin setæ. *Ocelli* 2 inter oculos et antennas vel potiùs paullò ante antennas positi. *Promuscis* 3-articulata, ad usque vel ultra basin pedum posticorum extensa. *Clypeus* trigonus basi truncatus. *Labrum* apice acutum. *Prothoracis dorsum* mesothorace paullò minus, posticè subemarginatum. *Hemelytra* alis minora, latitudine multò longiora, apice crebrè venosa et reticulata.

Species 1. Fulgora Laternaria.

F. capite porrecto, ovato, thorace majori, longitudine vix ejus latitudinem

duplò superante; hemelytris brunneo-rufescentibus, ad apicem nigro-variis, punctisque albo-farinosis, posticis apicem versus ocellatis.

Habitat in Americâ meridionali. Cayenne, Surinam.

Fulgora Laternaria. *Linn. Syst. Nat.* 2. 703, 1. *Stoll, Cigales, t.* 1, *f.* 1. *Roesel, Ins.* 2. *Gryll. t.* 28, 29. *Reaumur, Mem. Ins.* v. *t.* 20, *f.* 6, 7. *Fabr. Syst. Rhyng. p.* 1. *Germar in Thon's Arch.* ii. 2. *p.* 46. *Guérin Voy. de Belanger. Mag. de Zool. pl.* 174. *f.* 1, 2. *Burmeister, Handb.* ii. 169. *Palis. Beauv. Ins. d'Afr. et Amer. Hem. pl.* xix. *f.* 1.

Species 2. Fulgora Castresii.

F. lutea; fronte rostratâ subcylindricâ, rectâ, thorace angustiore, longitudine ejus latitudinem plùs duplò superante; hemelytris luteo-virescentibus, nigro-variegatis; alis brunneis, nigro-variegatis, apice ocellatis.

Habitat in Mexico.

Fulgora Castresii. *Guérin, Mag. Zool. pl.* 173. 174. *f.* 3. 4.

Species 3. Fulgora lucifera.

F. capite porrecto, cylindrico; alis lividis, nigro-variis.

Habitat in Brasiliâ.

Fulgora lucifera. *Germar, Magaz. der Entomol.* iv. 100. *Thon's Archiv.* ii. 46. *Brullé, Hist. Nat. Ins. Tom.* x. *pl.* 4. *f.* b?

" Simillima F. Laternariæ et forsan ejus varietas." *Germar.*

Species 4. Fulgora Candelaria.

F. fronte rostratâ adscendente; hemelytris viridibus, luteo-maculatis; alis flavis, apice nigris.

Habitat in Chinâ.

Fulgora Candelaria. *Linn. Syst. Nat.* ii. 703. 3. *Act. Holm.* 1746. *p.* 63. *t.* 1. *f.* 5. 6. *Fabr. Ent. Syst.* iv. 2. 4. *Syst. Rhyng. f.* 2. *Roesel, Ins.* 2. *Gryll.* 189. *t.* 30. *Stoll, Cigal. t.* 10. *f.* 46. *Burmeister, Handb.* ii. 168. *Donovan, Ins. China, pl.* 14. *Germar in Thon's Arch.* ii. 2. 46. (Flata C.) *Pal. Beauv. Ins. d'Afr. et Amer. Hem. pl.* xix. *f.* 2.

Species 5. Fulgora Lathburii.

F. fronte rostratâ adscendente; hemelytris viridibus, albo flavoque ocellatis; alis luteis, apice nigris; rostro suprà nigro apice tantùm rufo.

Habitat in Indiâ orientali.

Fulgora Lathburii. *Kirby in Linn. Trans.* xii. *p.* 450. *Guérin, Icon. R. An. Ins. pl.* 58. *f.* 2. *Germar in Thon's Arch.* ii. 2. *p.* 46. (Flata L.)

Species 6. Fulgora Pyrorhina.

F. fronte rostratâ adscendente, apice rubro incrassato; hemelytris fuscis, pallidè glauco maculatis, fasciâque pallidiori; alis nigris basi viridibus.

F. Candelariâ paullò major.

Habitat in Indiâ interiori. In Mus. D. Hope.

Fulgora pyrorhynchus. *Donovan, Ins. India, pl.* 7. *f.* 1. 1.

Fulgora pyrorhina. *West. in ditto, second edition, p.* 13.

Species 7. Fulgora clavata, *Westw.*

Tab. XII. fig. 1.

F. rostro corporis dimidii longitudine, piceo, apice in globum subrotundum testaceum terminato; hemelytris basi subalbidis, fusco-maculatis, apice fusco, albido ocellatis et maculatis.

Long. corp. cum rostr. lin. 16. Expans. hemelytr. lin. 36.

Habitat in Indiâ orientali. Assam.

In Mus. Dom. Hope et Cantor.

F. pyrorhinæ affinis. Rostrum cum capite piceum, albo-farinosum, corporis dimidii longitudine, e basi sensim attenuatum, dorso tricarinato, apiceque adscendente, et in globum subrotundum, subpellucidum, lætè testaceum terminato. Thorax luteus, prothorace punctis duobus minutis discoidalibus minutis nigris; mesothorax maculis quatuor basalibus, alterisque duabus obliquis lateralibus. Abdomen subtùs fulvum, suprà obscurum, albo-farinosum, segmentorum apicibus luteis anoque nigro. Hemelytra dimidio basali subalbido, maculis numerosis, irregularibus, fuscis; dimidio apicali fusco, maculis numerosis, albidis, rotundatis, magnitudine maximè variis, majoribus ocellatis. Alæ subalbidæ, apice latè fusco. Pedes nigri. Clypeus luteus. Promuscis nigra.

Species 8. Fulgora maculata.

F. capite rostrato adscendente, nigro, apice graciliori; nigra, hemelytris glauco-maculatis; alis basi cœruleis.

Habitat in Indiâ orientali.

Syn. Fulgora maculata. *Olivier, Enc. Méth.* vi. 568. 5. *Stoll, Cigal. f.* 143. *Burmeister, Handb.* ii. *p.* 169. *Germar in Thon's Archiv.* ii. 2. 46. (Flata m.)

Species 9. Fulgora annularis.

F. capite rostrato adscendente, apice subclavato, basi spinoso; fusca; alis nigris albo-maculatis (Præcedentibus paullò minor.).

Habitat in Surinam.

Fulgora annularis. *Oliv. Enc. Méth.* vi. 568. 6. *Stoll, Cigal. fig.* 69. *Germar in Thon's Arch.* ii. 2. 47. (Flata a.)

Species 10. Fulgora Horsfieldii, *Westw.*

Tab. XII. fig. 2.

F. rostro breviori, recto, apice truncato; pallidè griseo-lutea; hemelytris fusco-irroratis; alis albo-farinosis, apice nigro, maculis albis.

Long. corp. cum rostr. 1 unc. Expans. hemelytr. $2\frac{1}{6}$ unc.

Habitat in Javâ. Dom. Horsfield.

In Mus. Soc. mercat. Ind. orient. Londin.

F. annulari affinis, at colore alarum abundè diversa. Rostrum cum capite, longitudine pro- et mesothoracis, rectum, tenue, crassitudine æquale, apice truncato (mutilato), griseo-luteum, utrinque carinâ minutâ elevatâ. Pro- et mesothorax lutei, nigro-punctati. Abdomen sordidè brunneo-luteum. Hemelytra fusco-reticulata, maculisque nonnullis minutis subapicalibus luteis, albo-farinoso cinctis, costâ maculis 5 irregularibus fusco-reticulatis æquidistantibus, nubilâque majori reticulatâ fuscâ, paullò pone medium hemelytrorum. Alæ albæ, farinosæ, apice nigro, maculis rotundatis, albis. Pedes fulvo-lutei, tibiis 4 anticis totis apiceque 2 posticarum, tarsisque omnibus nigris.

Species 11. Fulgora apicalis.

Tab. XII. Fig. 3.

F. fronte rostratâ thoracis longitudine, gracili; fulvo-fuscescens; hemelytris fulvis, apice hyalinis, fusco-maculatis; alis hyalinis, basi fusco et miniato variis.

Long. corp. cum rostro, lin. 12. Long. rostr. lin. 3½. Expans. alar. lin. 20.
Habitat in Manilâ. D. Cuming.

Præcedentibus minor. Caput anticè productum in tubulum gracilem porrectum thoracis longitudine, apice paullò incrassatum. Caput et prothorax luteo-fulva, nigro-punctata; mesothorax obscurior, carinâ mediâ, maculisque nonnullis ad basin nigris. Abdomen magnum, subdepressum, luteo-fuscum, apice obscuriore. Hemelytra angusta, luteo-fulva, disco paullò obscuriora, marginibus antico et postico nigro-punctatis, apice hyalino punctis nigris plùs minùsve confluentibus. Alæ posticæ, subangustæ, hyalinæ, nervis nigris, dimidio basali fusco et miniato variegatis, margine antico magis obscuro. Pedes quatuor antici lutei, nigro-fasciati, tarsis nigris. Pedes 2 postici lutei, femoribus, nisi ad apicem, nigricantibus.

Species 12. Fulgora decorata.

Tab. XII. Fig. 4.

F. fronte rostratâ adscendente, corporis ferè longitudine; capite thoraceque viridibus; metathorace, abdomine, alisque sanguineis, his apice nigris; hemelytris ferrugineis, apice fuscis.

Long. corp. cum rostro, lin. 12½. Long. rostr. lin. 5½. Expans. alar. lin. 21.
Habitat in Javâ. In Mus. Reg. Paris.

A præcedente rostro longiori corporeque majori differt. Caput in rostrum valdè elongatum, gracile, adscendens productum, viride, maculâ parvâ utrinque ante oculos pigrâ; basi suprà carinatâ. Prothorax viridis, maculis 4 nigris. Mesothorax etiam viridis, basi punctis 4 intermediis, 2 majoribus, lateribusque etiam punctis duobus nigris; metathorax cum abdomine sanguineus. Hemelytra ferruginea, punctis numerosissimis, nigris, inter

nervos dispositis; apice sensim magis infuscatis, nervis sanguineis, punctisque circiter 12 parvis miniatis duplici serie transversâ dispositis. Alæ sanguineæ; margine exteriori nigro. Pedes virides, apice tibiarum tarsisque fuscis.

Species 13. Fulgora oculata.

Tab. XII. Fig. 5.

F. fronte rostratâ adscendente, corporis longitudine; griseo-fulvescens; hemelytris ocellis fulvis; alis albis, basi viridibus, margineque antico roseo tinctis.

Long. corp. cum rostro, lin. 16½. Expans. alar. lin. 30.

Habitat in Indiâ Orientali. In Mus. Reg. Paris.

Caput in rostrum gracile, adscendens, corporis longitudine productum. Pallidè griseo-fulva, abdomine alisque albo-farinosis. Mesothorax magis fulvescens. Hemelytra griseo-fulva, pallida, maculis ocellatis circiter 24 fulvis annulis albidis cinctis. Alæ albo-farinosæ, basi pallidè virescentes, margineque antico in medio plagâ magnâ roseâ, maculâ fuscâ terminatâ, alterâque minori medium versus. Pedes pallidè griseo-lutei, tibiis tarsisque 4 anticis, cum tarsis posticis nigris.

Species 14. Fulgora tenebrosa.

F. capite rostrato breviori, apice truncato; hemelytris griseis nigro-scabris; alis fusco-nigris.

Habitat in Guineâ.

Syn. Fulgora tenebrosa. *Fabr. Sp. Ins.* ii. *p.* 314. *No.* 9. *Syst. Rhyng. p.* 3. *Stoll, Cigal. t.* 2. *f.* 7. *Burmeister, Handb.* ii. 169. *Germar in Thon's Archiv,* ii. 2. 47. (Flata t.)

Fulgora Laternaria fusca. *De Geer, Mem.* iii. 200. *t.* 32. *f.* 1.

Fulgora africana. *Pal. Beauv. Ins. d'Afrique, &c. Hem. pl.* xix. *f.* 3.

Obs. Individuum in Mus. Banksiano (nunc in Mus. Soc. Linn. Lond.) à Fabricio descriptum, alas possedit pallidiores quàm in individuis recentioribus.

Species 15. FULGORA FLAMMEA.

F. " fronte rostrata adscendente, tereti, truncata; tota superius sordide ferrugineo-cinerascens; elytra ad apices a pagina superiore punctis obscurioribus, tota striæ obliquæ secant ut in serpentum cute." Linn. Am. Acad. " Alæ inferiores fuscæ." Linn. Syst. Nat. " Minor Cicada Candelaria."

" *Habitat* —— ? De Geer." Linn. Amœn. Acad. " In America." Linn. Syst. Nat. " In America meridionali," Fabr.

Syn. Fulgora flammea. *Linn. Amœn. Acad.* vi. 399. 39. *Syst. Nat.* ii. 704. 7. *Fabr. Ent. Syst.* iv. 3. 8. *Syst. Rhyng. p.* 3. (Excl. Syn. Stollii ?)

Obs. It is perhaps impossible to determine precisely this species at the present day. Linnæus, indeed, says it is smaller than the common Chinese species, and in the *Systema Naturæ* he, as well as Fabricius subsequently, gives America as the habitat; so that it cannot be *Fulgora tenebrosa*, as cited by the latter author, which is as large as *Candelaria*, and an inhabitant of Africa. On the other hand, the description of the spotting of the hemelytra and the colouring of the hind wings, together with the circumstance that Linnæus refers to De Geer's collection for the species, that author having subsequently figured an insect of unknown locality (and being in all probability the identical specimen examined by Linnæus,) agreeing with *Fulgora tenebrosa*, seem to prove that the Linnæan *F. flammea* is identical with the Fabrician *F. tenebrosa*. Olivier (*Enc. Méth.* vi. 170.) is certainly in error in giving Stoll's fig. 29. (which is the *Raphirhinus fasciatus*,) as this insect.

Species 16. FULGORA PUNCTATA.

F. capite rostrato corporis ferè longitudine, recto, apice truncato; grisea, nigro-punctata; elytris griseo-hyalinis, punctis numerosis nigris adspersis: alis albis venis fuscis; abdomine griseo.

Habitat in Guineâ.

Syn. Fulgora punctata. *Oliv. Enc. Méth.* vi. 569. *Stoll, Cigal. fig.* 28. *Germar. in Thon's Arch.* ii. 2. 47. (Flata p.)

Præcedente minor et gracilior.

Species 17. Fulgora marginata.

F. capite rostrato corpore dimidio breviori, recto, apice truncato; grisea, nigro-punctata; elytris griseo-hyalinis, nigro-punctatis; alis albis venis nigris; abdomine nigro; segmentorum marginibus luteis.

Long. corp. cum rostro, lin. 9. Expans. alar. lin. 14½.

Habitat in Promontorio Bonæ Spei. In Mus. D. Hope.

Syn. Fulgora punctata. *G. R. Gray in Griff. An. K. Ins. pl.* 90. *f.* 1. (nec Oliv. Germ.) *Burmeister, Handb. der Ent.* ii. *p.* 398.

Præcedentibus duabus multò minor, et pro magnitudine robustior. Caput, pro- et mesothorax, et hemelytra pallidè griseo-lutea, punctis minutis nigris adspersa, margineque antico hemelytrorum parùm fulvescente, his etiam punctis nonnullis majoribus nigris notatis. Rostrum dimidii corporis longitudine, rectum, sensim attenuatum, apice obliquè truncato, lateribus punctis minutis fulvis, apiceque ejus et mesothoracis fulvescenti. Hemelytra angusta. Alæ albo-hyalinæ, venis nigris. Abdomen segmento basali fulvo, in medio nigro, reliquis nigris, margine postico tenui albido. Pedes luteo-grisei, fulvo nigroque punctati; tibiæ posticæ breviores.

Species 18. Fulgora affinis.

Tab. XII. Fig. 6.

F. fronte rostratâ ferè corporis longitudine, apice truncato; luteo-grisea; thorace pedibus et hemelytris punctis nigris adspersis; abdomine suprà nigro; alis albis, venis pallidis.

Long. corp. cum rostro, lin. 16. Expans. alar. lin. 26.

Habitat in Nepaliâ. D. Hardwicke. In Mus. D. Hope.

F. tenebrosâ paullò minor, hemelytris multò pallidioribus, absque colore ferrugineo, punctisque nigris in venas distinctioribus. Caput cum rostro, pro- et mesothorax et hemelytra pallidè lutea, punctis nigris, magnitudine variis, adspersa; rostrum ferè corporis longitudine, porrectum, ferè rectum, subcylindricum, apice obliquè truncato, fusco-luteo, punctis scabro, apice pallidiori. Puncta nigra hemelytrorum in venas longitudinalitèr disposita; alæ albæ, subopacæ, apicem versùs paullò infuscatæ, venis nisi ad basin pallidioribus. Abdomen nigrum, margine segmentorum tenui,

luteo. Pedes breves, lutei; femoribus, annulo subapicali; tibiis annulis tribus nigris.

Obs. This species is represented amongst General Hardwicke's collection of drawings of the haustellated insects of Nepaul, now in the library of the British Museum.

Species 19. FULGORA COGNATA.

F. griseo-fulvescens; abdomine concolori; hemelytris pallidioribus, nigro-punctatis; alis albis, venis pallidis.

Expans. alar. lin. 14.

Habitat ——? In Mus. D. Hope.

Affinis *F. punctatæ,* at magnitudine *F. marginatæ* æqualis. Individuum unicum, pro descriptione nimis mutilatum, tantùm vidi.

Species 20. FULGORA OBSCURATA.

TAB. XII. Fig. 7.

F. fronte rostratâ rectâ, truncatâ; hemelytris latis, luteo-cinereis, nigro-maculatis et punctatis; alis hyalinis; clypeo maximo.

Long. corp. cum rostro, lin. $8\frac{1}{2}$. Expans. alar. lin. 15.

Habitat in Novâ Hollandiâ. In Mus. Soc. Linn. Lond. (olim Banks.).

Syn. Fulgora obscurata. *Fabr. Sp. Ins.* ii. 315. 10. *Syst. Rhyng. p.* 3. (excl. syn. *Stollii*). *Germar in Thon's Arch.* ii. 2. 47. (Flata o.).

F. dilatatæ affinis, statura ejusdem, at paullò minor, rostro crassiori, punctis subocellatis hemelytrorum nullis. Luteo-cinerea, fusco-variegata. Caput oculis prominulis, clypeo maximo, fusco et albido transverse strigosa. Rostrum corporis dimidii longitudine, rectum, apice truncatum, ante apicem suturâ elevatâ, et carinis duabus elevatis longitudinalibus. Prothorax in lobum rotundatum anticè productus, fusco-varius. Hemelytra lata, luteo-cinerea, atomis fuscis in venas dispositis, punctis nonnullis majoribus interdùm longitudinalitèr confluentibus, plagas longitudinales aut lanceolatas efficientibus; costâ externè punctatâ; alæ hyalinæ, venis fuscis. Pedes pallidi, fusco-annulati, breves; postici serrati. Abdomen suprà obscurè fulvum, latum.

There are two specimens of this species preserved in the Banksian cabinet in the Museum of the Linnean Society, which afforded Fabricius the original description. They vary in the size of the dark marks upon the hemelytra, but are otherwise identical. My figure is taken from the darker individual.

Species 21. Fulgora dilatata.

Tab. XII. Fig. 8. & 9.

F. capite rostrato, rostro dimidii corporis longitudine, apice attenuato; griseo-fuscescens; abdomine fulvo, apice segmentorum nigris; hemelytris pallidè cinereis, venis nigris et roseis, in singulo ocellis 12 roseis et nigris.

Long. corp. cum rostro, lin. 8.; long. rostri, lin. 3. Expans. alar. lin. 17.

Habitat in Novâ Hollandiâ ad "Swan River." In Mus. D. Hope.

F. obscuratæ, Fab. valdè affinis, et ejusdem statura, at paullò major, rostro magis gracili, hemelytris subocellatis. Corpus deplanatum. Caput et thorax fulvo-fusca, nigro-punctata, rostro dimidii corporis longitudine, apice attenuato, margine suprà subserrato (fig. 8*a.*) subtùs 3-carinato. Oculi pallidè fusci; prothorax in lobum rotundatum inter oculos (in medio subemarginatum) productus; mesothorax 3-carinatus; metathorax suprà ocello transverso, ovali, membranâ tecto instructus. Abdomen depressum, fulvum, margine postico segmentorum nigro. Hemelytra ad costam dilatata, pallidè cinerea, venis nigro et roseo variis, punctisque, in singulo 12 nigris, anticè roseis; alæ albæ, hyalinæ, venis fusco-roseis. Pedes albo-tomentosi, pallidè luteo-fulvi; tibiis 4 anticis fusco-annulatis.

Species 22. Fulgora nobilis?

Tab. XII. Fig. 10.

F. capite rostrato, rostro ferè corporis longitudine recto, tuberculis acutis nigris in lineas 6 dispositis; grisea, virescenti-tincta, nigro-punctatissima; hemelytris punctis fulvis; alis albis.

Long. corp. cum rostro, lin. 30. Long. rostr. lin. 12. Expans. alar. lin. 55.

Habitat in Malaccâ. In Mus. D. Hope.

Species perinsignis, *F. serratæ* affinis quoad rostrum serratum, et *F. punctatæ* et affinibus, corpore et hemelytris nigro-punctatissimis. Caput in rostrum

rectum, sensim attenuatum, apice obliquè truncatum productum, tuberculis nigris acutis, in lineis sex longitudinalitèr dispositis, scil. 2 suprà, 2 lateralitèr, et 2 subtùs; oculi pallidè fusci, tuberculo pallido, acuto, pone oculos. Antennæ pallidæ. Caput pro- et mesothorax et hemelytra luteo-grisea, virescenti parùm tincta, punctis minutis nigris adspersa. Metathorax et abdomen fulvo-fusca, hoc maculis transversis nigris. Hemelytra punctis numerosis majoribus fulvis etiam ornantur. Alæ albæ, subopacæ, venis pallidis, virescenti-tinctis. Pedes concolores, nigro-fasciati; tibiis posticis intùs immaculatis, externè nigro-punctatis; tarsis luteis; unguibus nigris. Promuscis pedes posticos vix attingit.

Species 23. FULGORA SERRATA.

F. capite rostrato adscendente, quadrifariàm serrato; fusco-grisea; alis posticis cœruleis, maculâ ocellari flava.

Habitat in Americâ Meridionali. In Mus. Soc. Ent. Lond. (olim Kirby).

Syn. Fulgora serrata. *Fabr. Sp. Ins.* ii. 313. 2. *Syst. Rhyng. p.* 2. *Lindenberg in Naturforsch.* xiii. *p.* 19. *t.* 3. *f.* 1. 2. *Stoll, Cigal. t.* 29. *f.* 170. *Germar in Thon's Arch.* ii. *fig.* 46.

Species 24. FULGORA DIADEMA.

F. capite rostrato muricato, apice trifido; hemelytris viridi, flavo, fuscoque marmoratis; alis nigris, basi sanguineo-variegatis.

Habitat in Americâ Meridionali. "In India." (Linn. errore).

Syn. Fulgora Diadema. *Linn. Syst. Nat.* ii. 703. 2. *Lindenberg in Naturforsch.* xiii. *p.* 20. *t.* 3. *f.* 3. *Stoll, Cigal.* i. *t.* 5. *f.* 22. *Fabr. Ent. Syst.* iv. 2. 3. *Syst. Rhyng. p.* 2. *Germar in Thon's Arch.* ii. 46. *Burmeister. Handb.* ii. *p.* 109. *Westw. in Drury Ill. 2nd edit. p.* 78. *Donovan, Nat. Repos. vol.* v. *fol.* 145.

Fulgora armata. *Drury, Ill.* 1*st edit. App. vol.* iii. *pl.* 50. *f.* 4.

Obs. Pedes postici haud serrati.

Species 25. FULGORA LINEATA.

F. capite rostrato adscendente, corporis dimidii longitudine; pallidè griseo-lutea; hemelytris elongatis, angustis, punctis nigris, in lineas ad marginem internum et ad costam apicis dispositis.

Long. corp. cum rostro (alis clausis), lin. 6.

Habitat in Indiâ Orientali. In Mus. Britann.

Syn. Fulgora lineata. *Donov. Ins. Ind. pl.* 8. *f.* 1.

Fulgora pallida. *G. R. Gray in Griff. An. K. Ins. pl.* 90. *f.* 2. *p.* 260.

Species minuta, et pro magnitudine gracillima. Pallidè testaceo- vel fulvo-albida. Pro- et mesothorax lineis rufescentibus. Caput anticè rostratum, rostro adscendente, dimidii corporis longitudine, gracili, ad apicem parùm incrassato. Hemelytra angusta, elongata, albida, punctis nigricantibus in lineas dispositis versus marginem internum et externum partis posticæ hemelytrorum, lineâ etiam tenui nigrâ basin costæ versus. Rostrum et pedes nigro-punctata; femoribus posticis ad apicem tarsisque latis.

Obs. In figurâ Donovani puncta nigra hemelytrorum confluentia videntur, lineas duas formantia, et totam longitudinem hemelytrorum percurrentia.

Species 26. FULGORA PLATYRHINA.

TAB. XII. Fig. 11.

F. capite producto plano, parallelipipedo; grisea; abdomine testaceo; hemelytris lineâ basali maculâque costali fuscis; alis roseis, apice hyalinis.

Long. corp. cum rostro, lin. 13. Expans. alar. lin. 30.

Habitat in Brasiliâ. In Mus. Soc. Ent. Lond. (olim Kirby). D. Hope. D. Winthem.

Syn. Fulgora platyrhina. *Germar in Thon's Arch.* ii. 2. *p.* 46.

Species 27. FULGORA? ENSIFERA.

F. capite rostrato compresso, adscendente; lurida; abdomine sanguineo; hemelytris hyalinis, fusco-maculatis, punctis duobus costalibus albis.

Habitat in Brasiliâ. Mus. D. Winthem.

Syn. *Germar in Thon's Arch.* ii. 2. 47. (Flata e.).

Obs. An *Fulgora?* an potius *Aphana? A. hæmopteræ* vel *tuberculatæ* affinior?

Species *Fulgoridarum* ad genus Aphana, Burm. (*Aphæna*, Guérin) amandandæ.

1. *Fulgora festiva*, Fab. Sp. Ins. ii. 315. Syst. Rhyng. p. 4. 17. Donov. Ins. Ind. pl. 7. f. 2.

Habitat in Coromandeliâ. Mus. Soc. Linn. & Soc. Ent. Lond.

2. *Fulgora hæmorrhoidalis*. Oliv. Enc. Méth. vi. 569. Germar in Thon's Arch. ii. 247. (Flata h.). Stoll, Cigal. fig. 148.

Habitat ad Caput Bonæ Spei.

Obs. Facies *F. festivæ*.

3. *Fulgora recurva*. Oliv. Enc. Méth. vi. 569. Germar in Thon's Arch. ii. 2. 46. Stoll, fig. 44. Burm. ii. 169.

Habitat in Brasiliâ. In Mus. nostr.

Obs. Antennam hujus speciei in tab. xii. fig. 12. depinxi.

4. *Fulgora Tuba*. Germar (Thon) ii. 2. p. 46. Burm.? 169. (exclus. Syn. Burm.) ii. p. 398.

Habitat in Brasiliâ.

Obs. Facies *F. recurvæ*.

5. *Fulgora tuberculata*. Oliv. Enc. vi. 569. Germar in Thon's Arch. ii. 2. 46. Stoll, fig. 122. Burm. ii. 169.

Habitat in Surinam.

6. *Flata hæmoptera*. Perty, Del. An. art. Bras. tab. 35. f. 3. Burm. ii. 398. (Fulgora h.)

Habitat in Brasiliâ. In Mus. nostr.

Obs. Antennam hujus speciei in tab. xii. fig. 13. depinxi.

7. *Flata cicatricosa*. Germar in Thon's Arch. ii. 2. 47.

Habitat in Brasiliâ.

Obs. Caput suprà planum, marginatum, trigonum, parùm productum, obtusè trigonum, anticè ferè rotundatum; elytra sordidè viridia, apice fusco-maculata. Alæ hyalinæ.

8. *Fulgora nigro-maculata*. G. R. Gray in Griff. An. K. Ins. pl. 90. f. 6. Burm. ii. 398. (Aphana n.) Guérin, Voy. Du Belanger.

Habitat in Chinâ. In Mus. D. Hope.

9. *Fulgora variegata.* (Oliv. Enc. Méth. vi. 573. Germar in Thon's Arch. ii. 2. 46. Stoll, fig. 45.). Genus Phænax (Germ. in Silberm. Rev. Ent. Eumallia, Guérin. Voy. Belanger) constituit.
Habitat in Brasiliâ.

Species *Fulgoridarum* ad genus *Pseudaphana*, Burm. (*Dictyophora*, Germar.) removendæ.

1. *Fulgora Europæa.* Linn. Syst. Nat. ii. 704. 9. Stoll, Cig. f. 51. Germar in Thon's Arch. ii. 2. 47. (Flata E.). Burmeister, ii. p. 160. (Pseudaphana E.).
Habitat in Europâ.
2. *Fulgora hyalinata.* Fabr. Sp. Ins. ii. 315. Syst. Rhyng. p. 4. Germar in Thon's Arch. ii. 2. 47. (Flata *h.*). Burm. ii. 160. Donovan, Ins. Ind. pl. 7. f. 3.
Habitat in Bengaliâ.

3. *Fulgora pallida.* Donovan, Ins. Ind. pl. 8. f. 2.
Habitat in Indiâ Orientali.

4. *Flata pungens.* Germar in Thon's Arch. ii. 2. 47. Burm. Handb. ii. 160. (Pseudaph. p.).
Habitat in Americâ Septentrionali.

5. *Flata pannonica.* Creutzer. Germar in Thon's Arch. ii. 2. 47.
Habitat in Hungariâ.

6. *Fulgora vivida.* Fabr. Ent. Syst. Suppl. 519. 10. (Flata v.). Syst. Rhyng. p. 5. (Fulgora v.). Germar in Thon's Arch. ii. 47. (Flata v.). Stoll, fig. 64? *Fulgora conica.* Oliv. Enc. Méth. vi. 571.? Burm. Handb. ii. 160. (Pseudaphana v.)
Habitat in Americæ insulis.

7. *Fulgora tænia.* Fabr. Syst. Rhyng. p. 5.
Habitat in Guineâ. ("Statura *F. fenestratæ*," Fabr.).

8. *Fulgora fenestrata.* Fabr. Ent. Syst. iv. 6. 18. Germar (Thon.) ii. 2. 48. (Flata f.). Palis. Beauv. Ins. d'Afrique, &c., Hém. pl. xix. f. 4.

Habitat in Africâ Æquinoctiali. In Mus. Soc. Linn. Lond. (olim Banks.)

Obs. Magnitudo *Ps. Europææ.*

Individuum vidi in Mus. Fabr. Kiliæ conserv. magnitudine *F. europææ*, at angustior rostroque parùm longiori.

9. *Fulgora virescens.* Fabr. Syst. Rhyng. p. 4. Germar in Thon's Arch. ii. 2. 47. (Flata v.). Stoll, Cigal. fig. 18.
Habitat in Americâ Meridionali.

10. *Fulgora graminea.* Fabr. Syst. Rhyng. p. 4. Germar in Thon's Arch. ii. 2. 47. (Flata g.). Burm. ii. 160. (Pseudaphana g.)
Habitat in Indiâ Orientali.

11. *Flata lyrata.* Germar in Thon's Arch. ii. 2. 47. Burm. Handb. ii. 160. (Pseud. l.).
Habitat in Bengaliâ.

12. *Fulgora noctivida.* Linn. Syst. Nat. ii. 704. 5. Fabr. Syst. Rhyng. p. 3. Burm. ii. 160. (Pseudaph. n.). *Cicada conirostris.* De Geer, Ins. t. 3. p. 202. pl. 32. fig. 4, 5.
Habitat in Surinam.

13. *Flata splendens.* Wiedemann. Germar in Thon's Arch. ii. 2. 48.
Habitat in Javâ.

Species *Fulgoridarum* ad genus *Pæciloptera,* Latr. revocandæ.

1. *Fulgora truncata.* Linn. Syst. Nat. ii. 704. 8.
"*Habitat* in Java; in America," *Linn.* In Mus. Soc. Linn. Lond. (olim Linn.).

2. *Fulgora folium.* De Geer, Ins. iii. 204. f. 32. f. 7. Gmelin, Ann. p. 2092.
Habitat in Americâ.

3. *Fulgora Bonellii.* Latr. Gen. Crust., &c. iii. p. 166.; ad genus *Eurybrachis* pertinet. (Burm. Handb. ii. 150.)
Habitat in Europâ Australiori.

Species ad familiam *Cercopidarum* pertinentes olim *Fulgoræ* ab auctoribus adscriptæ.

1. *Fulgora fasciata.* Fabr. Ent. Syst. iv. 4. 12. Syst. Rhyng. p. 4. Stoll, Cigales, fig. 29. Burm. Handb. ii. 120. (Tettigonia f.)

Raphirhinus obliquatus. Laporte, Ann. Soc. France, i. 415. 3.

Habitat in Cayennâ, Brasiliâ.

Obs. Ad genus *Tettigonia,* et subgenus *Raphirhinus,* Laporte, pertinet.

2. *Fulgora phosphorea.* Linn. Syst. Nat. ii. 704. 4. Fabr. Ent. Syst. iv. 3. 5. Syst. Rhyng. p. 2. Burm. Handb. ii. 120. (Tettigonia p.). Stoll, Cig. f. 42, 43.

Cicada filirostris. De Geer, Mem. iii. p. 201. t. 32. f. 6.

3. *Fulgora adscendens.* Fabr. Ent. Syst. 4. 4. 11. Syst. Rhyng. p. 3. 11.

Habitat in Surinam, Brasiliâ.

Obs. Ad genus et subgenus eadem cum præcedente.

4. *Fulgora parva.* Donov. MS. New Holl. pl. 9. f. 2. fortè congener præcedentium.

5. *Fulgora lucernaria.* Linn. Syst. Nat. ii. 704. 6. Burmeister, Handb. ii. 120. (Tettigonia l.).

Fulgora lucernea. Fabr. Ent. Syst. iv. 3. 7. Syst. Rhyng. p. 3.

Cicada brevirostris. De Geer, Mem. iii. p. 202. t. 32. f. 6.

Habitat in Surinam.

Obs. Ad *Tettigoniam* pertinet.

Species subsequentes ad eandem familiam pertinent, et genus novum, *Eupelici* affine, forsan constituunt.

1. *Fulgora plana.* Fabr. Mant. Ins. ii. 26. Syst. Rhyng. p. 65. 21. (Cicada p.).

Habitat in Guianâ.

2. *Fulgora pallipes.* Fabr. Mant. Ins. ii. 261. Syst. Rhyng. p. 66. 22. (Cicada p.).

Habitat in Guianâ.

3. *Fulgora planirostris.* Donov. Ins. New Holl. pl. 9. f. 1.

Habitat in Novâ Hollandiâ.

EXPLANATION OF TAB. XII.

Fig. 1. *Fulgora clavata.*
2. *Fulgora Horsfieldii.*
3. *Fulgora apicalis.* 3*a*. Front of head, seen laterally.
4. *Fulgora decorata.* 4*a*. Apex of rostrum, seen laterally.
5. *Fulgora aculeata.* 5*a*. Apex of rostrum, seen laterally.
6. *Fulgora affinis.*
7. *Fulgora obscurata,* Fabr. 7*a*. Head, seen laterally.
8 & 9. *Fulgora dilatata.* 8*a*. Head, seen laterally.
10. *Fulgora nobilis.* 10*a*. Head, seen laterally.
11. *Fulgora platyrhina.* 11*a*. Head, seen laterally.
12. Antenna of *Aphana recurva.*
13. Antenna of *Aphana hæmoptera.*

VII. *On the Structure and Affinities of* Arachis *and* Voandzeia.

By George Bentham, *Esq., F.L.S.*

Read May 1st, 1838.

The genus *Arachis*, hitherto consisting of the single species *A. hypogæa*, was universally described by the older authors as having a bipartite calyx, a resupinate corolla, the pistil included within the staminal tube, and the style of about the length of the ovarium: the flowers were all considered as pedunculate, and it was observed that the upper flowers were usually sterile, whilst in the lower ones the peduncle became reflexed and lengthened till it reached the ground, which it entered, and the fruit was there matured. Such is the idea given in the *Genera Plantarum* of Linnæus and of Jussieu; and Lamarck, in his Illustrations, figures various details of the reproductive organs, entirely in accordance with the above character. Poiteau subsequently (according to Poiret, *Encycl. Méth. Suppl.*) remarked, that what was usually taken for the peduncle of the flower, was in fact the tube of the calyx, within the base of which is contained the ovarium; and, accordingly, De Candolle and other modern botanists describe a calyx with a long thread-like tube and a bipartite limb, a corolla, somewhat resupinate, inserted at the top of the tube with the stamina; an ovarium borne on a short stipes within the base of the tube, with a long thread-like style and a bearded stigmate; the stipes of the ovarium is described as lengthening very rapidly after fecundation, so as to form that rigid peduncle which had been already observed to reach the ground before the fruit could mature itself. The legume is well known to be oblong, reticulated, indehiscent, and often somewhat torulose, and to contain from one to three seeds, with thick fleshy cotyledons and a straight radicle.

With these data great difficulties have occurred as to the immediate affinities of *Arachis* amongst the numerous genera composing the order of *Legu-*

minosæ. Linnæus placed it next to *Cicer,* Jussieu between *Ononis* and *Anthyllis.* De Candolle in classing the *Leguminosæ* strictly according to the embryo and the germination, as far as known, places *Arachis* amongst his *Geoffroyæ,* or *Papilionaceæ* with combined stamina and a straight embryo; at the same time, well aware of the little real affinity between *Arachis* and the arborescent *Geoffroyæ,* he suggests the probability of its forming with *Voandzeia* a small distinct tribe. *Voandzeia* has, however, since been discovered, both by Ernest Meyer and by Decaisne, to have a curved embryo, and has been removed to *Phaseoleæ,* and *Arachis* remains alone amongst genera with which it is connected by the single character derived from the embryo.

The very obvious resemblance of the flowers with those of *Stylosanthes* first led me to suppose that it might be better placed amongst *Hedysareæ,* where the peculiar foliage of *Arachis* is not uncommon; and a closer examination of the structure of the organs of fructification in both genera has furnished some remarkable peculiarities which seem still further to connect them.

The perfect flowers of *Arachis,* accurately described by De Candolle as to the calyx, corolla, stamina, ovarium and style, have appeared to me to be constantly sterile; they have, indeed, a perfect ovarium with two or three ovules, but I have always observed it to fall off with the calyx, and the legumes, as far as I have been able to ascertain from dried specimens of several species in various states, arise constantly from female flowers of a very different structure. These have neither calyx, corolla, nor stamina, but from between two bracteolæ, similar to those which are found at the base of the sterile flowers, proceeds a stiff rigid stipes or torus, which is speedily reflexed and elongated, and is terminated by what appears to the naked eye a sharp point. Examined under a glass this point discloses at its extremity a truncated, somewhat concave and dilated stigma; and within it will be found a cell, within which are lodged two or three ovoid, anatropous ovules placed transversely one above the other. After fecundation, when the extremity has nearly reached the ground, it begins to swell, but remains continuous with the stipes or torus, without any articulation even at the maturity, when the legume is usually broken off with more or less of laceration.

The perfect flowers in *Stylosanthes* are precisely similar to those of *Arachis,*

except that the calyx is rather less deeply divided; they are also usually sterile; at least, after examining several flowers of seventeen or eighteen species, I have only once observed a tendency on the part of the style to separate itself from the ovarium, whilst I have continually seen this organ wither and fall off with the calyx. The fertile flowers of *Stylosanthes* also resemble *Arachis* in the most important peculiarity that they are entirely without floral envelopes. The ovarium is, however, nearly sessile between the two bracteolæ, which always exist in both genera, and it is terminated by a short hooked style with a somewhat thickened stigma. During maturation it swells and separates into two articulations, without any elongation of the torus.

It is not impossible that the hermaphrodite flowers of *Stylosanthes* may also be occasionally fertile, but the hook which constantly terminates the legume seems to show that it proceeds from the hooked style of the naked flowers, and not from the straight end of the ovary of the perfect ones.

The chief point in which *Arachis* differs from *Hedysareæ* is in the legume, which does not separate into distinct articulations, a character regarded as absolute in all *Hedysareæ* with more seeds than one; and this is the reason that, notwithstanding the remarkable resemblance of the flowers to those of *Stylosanthes*, no one has as yet, to my knowledge, proposed bringing them together; but even in this point it will, perhaps, be found that *Arachis* is nearer to *Hedysareæ* than to any other tribe. As in the *Hedysareæ*, it has no valvular dehiscence, and its surface is marked with those remarkable reticulations, which, as far as I am aware, are peculiar to *Hedysareæ*; the young legume is often very much constricted between the seeds; and even the non-articulation may be accounted for by the underground maturation, a circumstance which has usually the effect of rendering indehiscent the underground legumes in amphicarpous species of which the upper legumes are dehiscent.

Voandzeia resembles *Arachis* in having sterile perfect flowers and apetalous fertile ones, which enter the ground to ripen the legumes, it has therefore been usually associated with *Arachis*; and I myself, when studying *Phaseoleæ* at Vienna, having no specimens of *Voandzeia* at the time, referred it with *Stylosanthes* to *Hedysareæ*: but in this I was mistaken; the underground fruits of most amphicarpous *Leguminosæ* proceed from apetalous flowers, so that that character alone would not connect *Voandzeia* with *Arachis* any more

than with *Vicia, Centrosema, Trifolium,* or others, and in other respects the two genera are very different. I have no perfect flowers in my specimens of *Voandzeia,* but they are not described as having the long calycine tube of *Arachis*: the fertile flowers have a calyx though they have no corolla, and the legume, though indehiscent from being subterraneous, has the sutures very prominent, and is not reticulated. The foliage, stipules, and inflorescence are entirely those of *Phaseoleæ,* to which tribe I should follow Ernest Meyer in referring it, although the want of the perfect flowers prevents me from ascertaining to which section of that tribe it approaches the nearest. Apetalous flowers are common in *Phaseoleæ,* as, for instance, in the genera *Galactia, Glycine, Amphicarpæa, Neurocarpum, Centrosema,* &c.

The following are the distinctive characters I should propose for the genera *Arachis* and *Stylosanthes,* to which I subjoin a synopsis of the species of *Arachis.*

Arachis. *Linn.*

Flores polygami. *Floris hermaphroditi sterilis: calyx* tubo longo filiformi, limbo subbipartito, labio superiore breviter 4-dentato, inferiore tenui integro. *Corolla* fauci calycis inserta. *Vexillum* suborbiculare. *Alæ* oblongæ, liberæ, transversim leviter plicatæ. *Carina* incurva, rostrata. *Stamina* monadelpha vexillari interdum abortiente. *Antheræ* alternæ subrotundæ, medifixæ; alternæ oblongæ, adnatæ. *Ovarium* intra tubum calycis subsessile, minutum, 2—3-ovulatum. *Stylus* ad antheras attingens, filiformis. *Stigma* minutum vel nullum? *Floris fœminei fertilis: calyx, corolla* et *stamina* nulla. *Ovarium* toro mox elongato reflexo rigido stipitatum, et cum eo continuum, acutum, intus uniloculare, simplici serie 2—3-ovulatum, ovulis ovoideis anatropis. *Stylus* brevissimus, subnullus. *Stigma* subdilatatum, terminale. *Legumen* intra terram maturescens, oblongum, crassum, reticulatum, indehiscens, subtorulosum, 2—3-spermum. *Semina* irregulariter ovoidea, cotyledonibus crassis carnosis, radicula recta brevi.

Herbæ humiles, sæpè prostratæ. *Folia* petiolata, abrupte pinnata, ecirrhosa, foliolis oppositis bijugis. *Stipulæ* basi petiolo adnatæ, striatæ. *Stipellæ* nullæ. *Flores* in spicam densam axillarem sæpius approximati, singuli

ad axillam folii vel bracteæ biauriculatæ stipularum pari similis solitarii, brevissime pedicellati, bracteolis 2 oppositis linearibus membranaceis ad apicem pedicelli sitis.

1. *A. hypogæa* (Linn. Sp. p. 1040.), annua, caule erecto vel adscendente ramoso piloso, foliolis obovatis obtusis mucronatis supra glabris subtus pilosulis.

In America tropica indigena? in calidioribus utriusque orbis culta. (v. s. cum fl. ☿ et ♀ et fr.).

2. *A. glabrata*, perennis, glabra vel hinc inde pilosula, adscendens, stipularum parte libera elongata ad foliorum par infimum subattingente, foliolis oblongo-ellipticis obtusis mucronatis basi rotundatis brevissime petiolulatis supra glabris subtus vix pilosulis.

Ad Rio Pardo Brasiliæ. (v. s. comm. a Mus. Acad. Petrop. cum fl. ☿).

Planta pusilla. *Foliola* semipollicaria. *Tubus calycis* 3—4 poll. longus.

3. *A. pusilla*, perennis? caule procumbente pilosulo, stipularum parte libera brevissima, foliolis ovatis oblongisve acutiusculis mucronatis basi rotundatis supra glabris subtus adpresse pubescentibus subsericeis.

In Serra Jacobina provinciæ Bahia Brasiliæ. *Blanchet, No.* 2669. (v. s. cum fl. ☿ et ♀).

4. *A. prostrata*, perennis, caule prostrato villoso, stipularum parte libera elongata at foliolorum par infimum non attingente, foliolis ovatis oblongisve obtusis mucronatis basi rotundatis supra glabris subtus adpresse villosis.

Ad Trahiras provinciæ Goyaz Brasiliæ. *Pohl.* (v. s. cum fl. ☿ comm. a Mus. Cæs. Reg. Vind.).

Caules elongati sæpe sub terram repentes.

5. *A. villosa*, perennis, caule prostrato villoso, stipulis foliolorum par infimum superantibus, foliolis lato-ovatis rigidis mucronatis supra pubescentibus subtus pilosis.

Ad Rio Grande Brasiliæ Meridionalis. *Tweedie.* (v. s. cum fl. ☿ et ♀).

Stipulæ longæ, rigidæ, nervosæ. *Calycis labium inferius* latius quam in præcedentibus.

6. *A. tuberosa* (Bongard, MSS.), perennis, caule brevi subsimplici villoso,

petiolis abbreviatis, foliolis obovatis oblongisve obtusis muticis basi angustatis rigidis marginatis reticulatis glabris subciliatis.

Ad Rio Pardo Brasiliæ. (v. s. comm. a Mus. Acad. Petrop. cum fl. ☿).

Radix apice in tuberculum oblongum inflata. *Stipulæ* infimæ (sub terra natæ ?) aphyllæ, superiores longæ rigidæ ciliatæ.

Amongst the above species I have seen the fruit of *A. hypogæa* only. It is probable that when the legumes are known, better distinctive characters may be found, or possibly that some of the above may be mere varieties of each other, but as far as my specimens go they appear perfectly distinct.

Stylosanthes. *Linn.*

Flores polygami. *Floris hermaphroditi sæpissime sterilis*; *calyx* tubo longo, filiformi, limbo profunde bilabiato, labio superiore 4-fido, laciniis supremis altius connatis, labio inferiore elongato, integro. *Corolla* fauci calycis inserta. *Vexillum* suborbiculare. *Alæ* oblongæ, liberæ, leviter transversim plicatæ, carina longiores. *Carina* incurva, subrostrata, apice integra. *Stamina* monadelpha. *Antheræ* alternæ subrotundæ, medifixæ; alternæ oblongæ, adnatæ. *Ovarium* intra tubum calycis subsessile, minutum, 2—3-ovulatum. *Stylus* ad antheras attingens, filiformis. *Stigma* minutum, rarius subcapitatum (floribus tunc fertilibus ?). *Floris fœminei fertilis*; *calyx*, *corolla*, et *stamina* nulla. *Ovarium* subsessile, erectum, biovulatum. *Stylus* brevis, uncinatus. *Stigma* incrassatum, subterminale. *Legumen* sessile, sæpius biarticulatum, articulis compressis, inferiore nunc sterili stipitiformi, nunc monospermo secedente, superiore monospermo secedente, apice stylo persistente hamato. *Semen* lenticulari-compressum. *Radicula* brevis, parum inflexa.

Herbæ, suffruticesve erectæ, vel prostratæ, sæpe viscosæ. *Folia* petiolata, pinnatim trifoliolata, foliolis oppositis, cum impari sæpissime distante, rarius inter lateralia subsessili. *Stipulæ* basi petiolo adnatæ, striatæ. *Stipellæ* nullæ. *Flores* in spicam densam, axillarem vel terminalem sæpius approximati, singuli ad axillam folii vel bracteæ stipularum pari similis breviter pedicellati, pedicello bracteæ adnato, nunc solitarii 2—3-bracteolati, nunc bini altero perfecto altero abortivo stipitiformi, rarius bini utroque perfecto.

Sixteen species of this genus have been lately characterized, and the new ones described, by Dr. Vogel (*Linnæa, v.* xii. *p.* 63). He divides the genus into two sections according to the presence and absence of the stipiform rudiment of a flower in the same axilla as the perfect one. This character appears constant in most instances, although in *S. viscosa*, Sw. (of which *S. glutinosa* and *S. humilis* of Kunth are probably mere varieties) I have observed sometimes two perfect flowers, sometimes a perfect one and a small stipiform rudiment with four bracteolæ, sometimes only the perfect flower with two, three, or four bracteolæ. Amongst the very few new species I should have to add to those of Vogel, there is nothing remarkable enough to make it worth while describing them on this occasion.

The genus *Voandzeia* remains confined to the single *V. subterranea*, Dup. Th.

Since the above has been in the press, I have received the second part of Torrey and Gray's Flora of North America, in which is described a curious new genus under the name of *Chapmannia*, closely allied to *Stylosanthes* in structure, but with the habit of some species of *Æschynomene* and *Adesmia*. As I am indebted to the kindness of the authors for specimens containing flowers in both states, I subjoin a full character drawn up in conformity with those I have above given of *Arachis* and *Stylosanthes*, adding a description of the fruit from a letter recently addressed by Dr. Torrey to Dr. Gray.

CHAPMANNIA. *Torr. et Gray.*

Flores polygami. *Floris hermaphroditi sæpissime sterilis; calyx* tubo filiformi, limbo breviter 5-fido, lacinia infima parum majore. *Corolla* fauci calycis inserta. *Vexillum* suborbiculare. *Alæ* obovatæ, carina breviores. *Carina* incurva, apice bifida, vexillo subæquilonga. *Stamina* monadelpha, alterna longiora. *Antheræ* consimiles oblongæ. *Ovarium* subsessile, glabrum, 2—3-ovulatum. *Stylus* filiformis, glaber, obtusus, longe exsertus. *Stigma* minutum (v. capitatum ?). *Floris fœminei fertilis; calyx, corolla, et stamina* nulla. *Ovarium* subsessile, erectum, hirsutum, 2—3-ovulatum.

Stylus brevissimus, incurvus. *Stigma* terminale, obliquum, incrassatum. *Legumen* (sec. Torrey *in litt.*) 1—3-articulatum, articulis indehiscentibus, oblongis, turgidis, hispidis, monospermis. *Radicula* recta.

Herba suberecta, hirsuta, viscida. *Folia* irregulariter impari-pinnata. *Stipulæ* liberæ, membranaceæ, deciduæ. *Racemi* terminales, laxi, subcompositi. *Pedunculi* 1—3-flori, floribus bibracteolatis ad axillam bracteæ ovatæ sessilibus.

In the ordinary perfect flowers I cannot find any trace of stigmatic papillæ, nor the slightest disposition on the part of the ovarium to swell, except in a single instance, where I observed a glabrous ovarium somewhat swollen, and apparently advancing towards maturity, surrounded by the withered tube of the calyx, and terminating in a short filiform style withered or broken off at the extremity.

Feb. 1839.

VIII. *Descriptions of two new Genera of the Natural Family of Plants called* Coniferæ. *By* David Don, *Esq., Libr. L.S., Prof. Bot. King's College.*

Read April 17th, 1838.

THE *Coniferæ* undoubtedly constitute one of the most interesting families in the vegetable kingdom, whether considered in connexion with the former vegetation of the earth, or in reference to their peculiarities of structure, or as objects of utility, affording to man an abundant supply of valuable materials employed extensively in the arts and domestic œconomy. Their habit and structure are so peculiar that they have been ranked as a separate family by the earliest writers on Systematic Botany. Richard in his valuable work, "Mémoires sur les Conifères et les Cycadées," has distributed the family into three groups, denominated by him, from the typical genera of each, *Abietineæ*, *Cupressineæ*, and *Taxineæ*; the first may be characterized by their female spikes forming a cone or strobilus, their ovula being in pairs, and by their scaly buds; the second by their reproductive organs having a tendency to become indefinite, by their naked buds, and other peculiarities of habit; the third by their female spike being usually reduced to a single flower, with a solitary, completely naked ovulum, whose external integument assumes a fleshy consistence and resembles an arillus. All three will be found to correspond remarkably in the structure of their male flowers; and the differences presented by their female inflorescence are more apparent than real, for they consist rather in the degree of reduction of parts than in actual structure. Their organs of nutrition present a remarkable degree of uniformity in their structure, and, indeed, it would be difficult to point out a family so completely natural, and one whose groups pass so insensibly into each other.

To the three groups above mentioned I propose to add a fourth, which may be named *Araucarineæ*, and to consist of *Araucaria*, *Dammara*, and perhaps *Cunninghamia*, which correspond with *Cupressineæ* in the tendency of their reproductive organs to become indefinite, in their naked buds, and in their general habit. This group being mutually related to *Abietineæ* and *Cupressineæ*, would

hold an intermediate station between them. Their indefinite thecæ, varying from 3 to 20, and their naked buds, will distinguish them from *Abietineæ*, while their fewer ovula, deciduous pericarpia, and strobiliform female spike will separate them from *Cupressineæ*. The species of *Araucaria* naturally separate themselves into two groups, characterized by peculiarities of habit and structure, as well as by their geographical distribution. The three Polynesian species having four cotyledons, and presenting a difference in the position of the leaves in the young and adult plants, have also fewer thecæ, and the crests of the anthers are short and closely imbricated; while the two South American species present no difference in the position of the leaves in the immature and adult plants; the crests of the anthers are elongated and squarrose, and the thecæ double the number. The Chilian *Araucaria imbricata* extends along the Cordilleras of the Andes from the 35° to about the 50° of S. latitude, while the Brazilian species occurs in the provinces of Rio de Janeiro and Minas Geraes between the 15° and 25° of S. latitude. The *Araucaria excelsa* appears to be exclusively confined to Norfolk Island, and the *Cunninghamii* to the east coast of New Holland, between the 14° and 30° of S. latitude; the other species (*A. Cookii*, Br.) is limited to New Caledonia and some small islands adjacent; and it is not improbable that the interior of New Guinea or Borneo may afford a fourth species of the same group, which, if it does not possess characters sufficiently important to rank as a distinct genus, it at least constitutes a very marked section, for which Salisbury's name of *Eutassa* may be retained. The Polynesian species are remarkable for having the vessels of their fibrous tissue furnished on the sides parallel to the medullary rays with two or three rows of closely approximated and alternating dots having a hexagonal outline; nor am I aware whether this peculiarity extends to the South American species, and to the genera *Cunninghamia* and *Dammara*, a point which I hope soon to be able to ascertain*.

* Having recently had an opportunity of examining the wood of *Araucaria imbricata* and *brasiliana*, and also of *Dammara orientalis*, I am now enabled to set this question at rest. The vessels composing their fibrous tissue present the same structure, having one or two rows of closely approximated dots with usually an angular outline, which, however, is not so regularly hexagonal as in *Araucaria excelsa* and *Cunninghamii*, from the circumstance of the dots being often in a single series, but when they happen to be arranged in two rows they are always alternate. The vessels of *Cunninghamia sinensis* have the dots in single rows, with a circular outline, but they are smaller and more numerous than in *Pinus*.

The work of Richard already mentioned, although of great value in a systematic point of view, threw comparatively little additional light upon the organization of this remarkable family of plants, from the circumstance of its learned author having either misunderstood or wholly overlooked many parts of their structure. We are indebted to Mr. Brown for having first pointed out the real nature of the parts of the female flower in this family. Richard, as is well known, adopted in a great measure the views of preceding botanists. He regarded the expanded pericarpia as bractes, the ovula as the flowers, the integument as the calyx, and the apex of the nucleus as the stigma, and the fleshy outer integument of the ovulum of *Taxus* (which is developed after fecundation) as a kind of involucrum. He moreover describes the flowers as inverted in *Abietineæ*, and erect in *Cupressineæ* and *Taxineæ*, and he considered the ovulum (nucleus) to follow the direction of the flowers. The two genera, which form the subject of this communication, belong to the *Cupressineæ*, a group distinguished, as I have before stated, by the tendency of their reproductive organs to become indefinite, by their persistent pericarpia, naked buds, and other peculiarities of habit. To his character of the group Richard added the form of the mature female spike, which is usually a galbulus, composed of peltate scales; but in the two genera which I am about to describe, that organ has assumed nearly the form of a cone, as in *Pinus*. The genera comprised in the *Cupressineæ* are *Cupressus*, *Thuja*, *Callitris*, *Taxodium*, *Juniperus*, and the subjects of the present paper. The structure of the fruit of *Juniperus* differs only from *Cupressus*, in the peltate scales becoming confluent and fleshy as the fruit advances towards maturity. This will be best understood by examining the female spike at an early stage, when it is scarcely possible to distinguish between the two genera. From its fleshy fruit some have supposed that *Juniperus* was related to *Taxus*; but that is a mere point of analogy, for in *Juniperus* the flowers and ovula are indefinite, and the scales or pericarpia unite and become fleshy, while in *Taxus* the female spike is reduced to a single flower, with a solitary, completely naked ovulum, whose outer integument becomes succulent, and altogether resembles a fleshy arillus.

The species of this group are pretty equally distributed in both hemispheres; but none of the genera are strictly confined to either, with the exception of *Taxodium* and *Cryptomeria* to the northern, and *Athrotaxis* to the southern.

hemisphere. A species of *Juniperus* occurs at Cape Horn, and one species of *Thuja* in Chile, and another at the Straits of Magellan; while *Callitris*, a genus containing more than twenty species natives of New Holland and Van Diemen's Land, has a solitary species on Mount Atlas in 35° North latitude.

CRYPTOMERIA.

Ord. Nat. CONIFERÆ. *Linn. Juss.*

Trib. II. CUPRESSINEÆ. *Rich.*

Character Essentialis.

Amenta mascula spicata. *Squamæ antheriferæ* rotundatæ, adpressè imbricatæ, sessiles. *Antherarum thecæ* 5, connatæ! basi squamarum omninò adnatæ, anticè foramine amplo dehiscentes. *Strobili* solitarii, globosi, squarrosi: *squamis* è pericarpio 3—6-dentato bracteâque lanceolatâ acuminatâ infernè concretis compositis. *Semina* 4 v. 5, erecta, inæquilateri-oblonga, margine angustè alata.

Character Generalis.

FLORES monoici.

MASC. *Amenta* plurima, ovato-oblonga, obtusa, sessilia, bracteata, unguicularia, in spicam terminalem vix uncialem aggregata. *Bracteæ* subulatæ, rigidæ, patulæ, amento parùm breviores. *Squamæ antheriferæ* sessiles, brevissimæ, rotundatæ, undique adpressè imbricatæ, ferrugineæ, hinc convexæ, lævissimæ, margine angustè membranaceæ; extimæ obsoletè carinatæ, subapiculatæ. *Antherarum thecæ* 5, rariùs 4 v. 6, brevissimæ, uniloculares, turgidæ, inter se connatæ, basi squamarum omninò adnatæ, anticè foramine amplo dehiscentes. *Pollen* è cellulis globosis lævibus compositum, pulverem sulphureum æmulans.

FŒM. *Amenta* in ramulorum apice terminalia, solitaria, sessilia, globosa, multiflora: *squamis* è pericarpio 3—6-dentato bracteâque lanceolatâ acuminatâ infernè concretis compositis, crassis, coriaceis, rigidis, unguiculatis, regione placentiferâ dilatatâ, fungosâ, vix protuberanti: *ungue* 2 lineas longo, verticalitèr compresso, hinc obtusè elevato-carinato, inde rectiusculo, convexo, sulcato. *Ovula* 4 v. 5, erecta, atropa, ovata, compressa, verticalia, invicem se subimbricata, margine angustè alata,

angulo interiore curvato margine latiore, exteriore rectiusculo parùm angulato, basi hilo oblongo, apice foramine obliquè terminali, tubuloso, ore orbiculato aperto instructa: *integumento* simplici. *Strobili* subrotundi, squarrosi, muricati. *Pericarpium* è foliorum verticillo? infernè conferruminato, simulque bracteâ concreto, supernè soluto in dentibus 6, rariùs 3—5, subulatis, compressis, sulcatis, rigidis, apice mucronatis, recurvis compositum. *Bracteæ* pericarpii longitudine, eodemque infernè accretæ, ovato-lanceolatæ, acuminatæ, subcarinatæ, apice libero recurvato. *Semina* 4 v. 5, inæquilateri-oblonga, compressa, collateralia, fusco-badia, margine angustè alata, hinc curvata, inde rectiuscula et parùm angulata: *testâ* crustaceâ: *albumen* carnosum, parcius. *Embryo* teres: *cotyledones* 2: *radicula* conica, brevissima, supera.

Arbor (japonica) *procera, sempervirens.* Truncus *rectissimus, crassitie pedalis.* Lignum *album, densè compactum: contextûs fibrosi vasa tenuissima, punctis minutis orbiculatis simplici ordine crebrè notata.* Ramuli *patuli.* Folia *ferè omninò* Araucariæ Cunninghamii, *5-fariàm ordinata, subulata, rigida, viridia, verticalitèr compressa, 4-sulcata, incurva, vix pollicaria, apice calloso obtusiuscula, basi in angulum carinatum decurrentia; adultiora persistentia; novella præsertìm ad ramulorum basin abbreviata, subimbricata.* Amenta mascula *aggregata;* fœminea *solitaria.* Antherarum thecæ *flavæ.* Strobili *subrotundi, vix juglandis magnitudine.*

Tab. XIII. Fig. 1.

1. C. japonica.

Cupressus japonica. *Linn. Fil. Suppl.* 421. *Thunb. Jap.* 265. *Willd. Sp. Pl. vol.* iv. 513. *Gærtn. Fruct. vol.* ii. *t.* 91. *Lam. Dict. vol.* ii. 244. *Ill. t.* 787. *f.* 2.

San, *vulgò* Ssugi. *Kæmpf. Amœn.* 883.

Habitat in Insulâ Nipponiæ, et in montibus circa Nagasaki urbem spontè vulgaris. *Kæmpfer, Thunberg.* ♄. (v. s. spont. à Thunbergio ipso communicatum in Herb. Linn. Fil. nunc in Mus. Soc. Linn.).

The present genus is one of great interest in a botanical point of view from the peculiarities of structure of its reproductive organs, as well as from its remarkable habit, which is so like that of *Araucaria* or *Eutassa Cunninghamii*.

that a branch of the one might readily be mistaken for that of the other. The leaves are evergreen, subulate, laterally compressed, and in other respects they closely resemble those of that plant. The structure of the reproductive organs is even more remarkable than in any other of the *Cupressineæ*. The male catkins, which in the other genera of that group are terminal and solitary, are here numerous, as in the normal tribe of *Pinus*, and crowded in a spike-like manner at the extremity of the branches. They are short, and the antheriferous scales are crowded, sessile, and closely imbricated, as in *Araucaria excelsa* and *Cunninghamii*. The thecæ, 5 in number, are unilocular, very short, combined together in a single series, concealed at the base of the scales, and open inwardly towards the axis by a large rounded aperture. The female spikes are solitary and borne on the same tree, and most frequently on the same branch, in which case they occur on the inferior branchlets. They are globular, squarrose. and about the size of a walnut. The most remarkable peculiarity of the genus, however, is that the composition of the male inflorescence seems to be reproduced in the female, the pericarpium apparently consisting of a verticil of leaves combined together, and concrete with the bracte, which is here much developed; the points of the pericarpial leaves, together with the upper portion of the bracte, are free, and crown the mature fruit in the form of subulate recurved teeth. The ovula vary from 4 to 5, and appear to bear some relation to the divisions of the pericarpium by which they are concealed. The more complex structure of this genus appears to militate against the view taken by Dr. Schleiden of the female flower of *Abietineæ* in his interesting memoir on the vegetable ovulum, of which a translation is given in that valuable periodical, the "Philosophical Magazine and Journal of Science," for February and March last. According to him, the ovula in all cases originate from the axis, of which the placenta is a modified portion; and he regards the scale, or what I have described as an expanded pericarpium, in *Abietineæ*, as, in reality, the placenta, and what has hitherto been regarded as the bracte as the true pericarpial leaf. This opinion he founds upon an examination of a monstrous spike of *Abies alba*, which upon the upper half bore female, and upon the lower half male, flowers, and he refers to an unpublished work of his for further details. With the very brief notice given in the memoir abovementioned, and in the absence of the proofs which are to be adduced by

Dr. Schleiden in support of his theory, it would be premature to enter into a full discussion of the subject upon this occasion; but whatever may prove to be the case in *Abietineæ*, we must, I think, admit that the remarkable organ in the present genus is really a pericarpium. In *Pinus* (*Picea*) *bracteata*, for example, these supposed pericarpia do not differ from the ordinary leaves; and in some other species the transition from them to leaves is imperceptible, the exterior ones being in most cases barren. The supposed placentæ present a foliaceous character in *Abies* and *Larix*, and in the Silver Firs, where the leaves are petiolate, the scales are constantly stipitate, and in all cases they follow the arrangement of the foliaceous organs, which, I think, would not be so uniformly the case were they portions of the axis, and not modifications of the leaves. This is beautifully shown in the following genus *Athrotaxis*, where the female spike presents all the appearance of a young branch.

In *Cunninghamia* and *Araucaria* we have only one organ present, which is clearly derived from the leaf, and which performs the office of the supposed placenta in *Pinus*, in the former genus bearing several ovula, and in *Araucaria* one only, with which it becomes confluent. The existence of a single floral envelope in these two genera may be accounted for either by supposing that the bracte and pericarpial leaf become confluent at an early period, or that what I have described as the bracte and pericarpium may constitute in all cases but one organ, the scale being merely the enlarged base of the pericarpial leaf; a view which would gain some support from the change which takes place in the leaves of diseased branches of the spruce fir. Pavon, in his memoir on *Araucaria imbricata*, describes and figures the free extremities of the pericarpial leaf and the wing of the ovulum, which are readily distinguishable in the young state, as a bivalved stigma.

Perhaps the genus *Callitris* of all others affords the most convincing proof of the origin of the supposed placentæ; for in the different species of that genus we uniformly find them regulated by the number of leaves in a verticil, which consists of three or four.

All these circumstances appear to confirm the accuracy of the view taken by Mr. Brown* that the scales are expanded pericarpia; and it seems more

* In justice, however, to this learned botanist, I ought to state that he was the first to suggest the very theory adopted by Dr. Schleiden as to the nature of the supposed pericarpia.—See Appendix to Capt. King's Voyage, vol. ii. p. 560.

natural to consider the placenta as forming a part only, than that it should constitute the whole of what we regard as the pericarpium.

The circumstance of buds being developed upon leaves is by no means so rare an occurrence as Dr. Schleiden supposes; for not only *Bryophyllum*, but *Kalanchoe, Rochea, Echeveria,* and other genera of *Crassulaceæ*, are well known to be readily propagated by their leaves, which give birth to buds, and where care has been taken to cut them off above the point of insertion, so as to avoid the possibility of any portion of the axis adhering to them. The segments of the leaves of *Cardamine pratensis* and *amara* separate from the midrib in autumn, take root, and give birth to a young plant. In the autumn of 1836, while walking round the gardens of the Marquis of Ailesbury at Tottenham Park, Wilts, I was much gratified by observing a number of plants of a variety of the common Cabbage (*Brassica oleracea*) having their leaves covered with innumerable buds on the upper surface along the costæ and veins. The petiole and lamina of such leaves in other respects presented the ordinary appearance. But the most convincing proof of the origin of ovula from the carpellary leaves is afforded by a singular variety of the common Wallflower (*Cheiranthus Cheiri*), first observed by Mr. Brown, in which the stamina are converted into open confluent carpels, which bear ovula at their margins*. These facts go clearly to prove the correctness of the opinion which derives the ovula from the carpellary leaves; and I am disposed to think that the case of the Yew (*Taxus*), singular as it is, will not be found to be an exception to the general law. I might also notice the female inflorescence of *Cycas*, which is clearly a modified frond, although I am aware that the mode of evolution of the fronds in that genus might be objected to their being leaves.

The wood in *Cryptomeria* is compact, and the fibrous tissue is composed of very slender vessels, united generally by their truncated ends, and furnished

* Mr. Brown, who has studied with great attention and success the various changes and deviations which take place in the organs of plants, had the kindness to show me a series of beautiful drawings of singularly instructive monstrosities, in some of which one half of the anther was seen to bear ovula at its margin, while the other lobe remained in the ordinary condition, and contained pollen, the filament being entirely unchanged, and showing clearly that no part of the axis was present.—See Linn. Trans. vol. xii. p. 90., and vol. xiii. p. 212, where these drawings are referred to by Mr. Brown.

on the sides parallel to the medullary rays with a single row of minute dots, with a circular outline, much smaller and more crowded than in *Pinus*. These characters agree with the *Cupressineæ*, and differ entirely from the fibrous tissue of *Araucaria Cunninghamii*, the vessels of which are furnished with two or three rows of dots having a hexagonal outline; a peculiarity attributable to pressure, and arising, doubtless, from their close contact prior to the full growth of the membrane composing the vessel.

The specimen from which my description of this remarkable tree was taken, is contained in the extensive collections of the Society. It formed part of the Herbarium of the younger Linnæus, having been communicated to him by his friend and successor Thunberg on his return from Japan, and it was afterwards incorporated with the collection of our late distinguished President and Founder Sir J. E. Smith.

The concealed position of the reproductive organs has suggested the generic name, which is derived from κρυπτος, *occultus*, and μερις, *pars*.

ATHROTAXIS.

Ord. Nat. CONIFERÆ. *Linn. Juss.*

Trib. II. CUPRESSINEÆ. *Rich.*

Character Essentialis.

Amenta mascula solitaria, multiflora, capitata, laxa. *Squamæ antheriferæ* longè unguiculatæ, subfastigiatæ. *Antherarum thecæ* 2, distantes, divaricato-patentes. *Strobili squamæ* indefinitæ, lanceolatæ, acutæ, regione seminiferâ incrassatâ. *Semina* 2 v. 3, compressa, pendula! margine altero alato.

Character Generalis.

FLORES monoici.

MASC. *Amenta* terminalia, solitaria, sessilia, capitata, rhachide brevissimâ subulatâ, squamis pluribus membranaceis involucrata. *Squamæ antheriferæ* longè unguiculatæ, subfastigiatæ, laxæ: *ungue* lineari-angustissimo, compresso: *limbo* oblongo, membranaceo. *Antherarum thecæ* 2, ovato-oblongæ, obtusæ, uniloculares, è baseos angulis squamarum limbi ortum

ducentes, oppositè distantes, ferè omninò liberæ, divaricato-patentes, ad peripheriam inferam rimâ bivalvi dehiscentes: *valvulis* convexis, cum ipsius squamæ substantiâ continuis.

Fœm. *Amenta* subrotundo-ovata, multiflora, sessilia: *squamis* è pericarpio bracteâque conferruminatis? compositis, indefinitis, ovato-lanceolatis, acutis, planiusculis, coriaceis, imbricatis, regione placentiferâ protuberanti. *Ovula* 3, atropa, obcordata, complanata, spadicea, à basi propriâ pendula! hilo obliquo transversè oblongo depresso badio placentæ adnata, margine membranaceo-alata, apice foramine brevissimè tubuloso brunnescenti, ore aperto æquali prominulo instructa: *integumento* simplici. *Strobili* subrotundo-ovati: *squamis* crassioribus, lignosis, stipitatis, stipite crasso subtetragono, regione seminiferâ valdè incrassatâ, apice ovato acuto coriaceo incumbente. *Semina* 3, v. sæpiùs tertio abortiente 2, ferruginea, margine altero (exteriore) dilatato alato, altero rectiore vix alato: *alâ* è testæ epidermide tantùm constitutâ: *testa* tenuis, crustacea.

Arbusculæ (tasmanienses) *sempervirentes facie Lycopodiorum, foliis imbricatis, amentis terminalibus solitariis sessilibus.*

Obs. Genus à Cupresso facilè distinguitur amentis masculis laxis capitatis, squamis antheriferis longè unguiculatis subfastigiatis, antherarum thecis 2 divaricatis, strobili squamis planiusculis acutis, seminibus pendulis alatis.

1. *A. selaginoides*, foliis lanceolatis acuminatis laxè 5-fariàm imbricatis, squamis antheriferis acutis.

Tab. XIV.

Habitat in Tasmaniæ montibus prope Launceston. *D. Gunn.* (n. 368.) ♄. (v. s. sp. in Herb. Lindl.).

Arbuscula, ut videtur, depressa, sempervirens, trichotomè v. rariùs dichotomè ramosissima. *Truncus* et *rami adultiores* infernè basibus foliorum adnatis persistentibus subquadratis parùm elevatis undique muniti. *Lignum* album, compactum; contextûs fibrosi vasa tenuissima, extremitatibus plerumque truncatis applicata, punctorum singulo ordine in utroque latere tubi parietum notata; puncta hæcce sunt parva, orbiculata. *Ramuli* breves, conferti, densissimè foliosi. *Folia* undique conferta, laxè 5-fariàm imbricata, spirali modo disposita, lanceolata, acuminato-mucronata, incurvata, coriacea, rigida, vix semipollicaria, suprà plana,

subtùs (extùs) convexa, obsoletè carinata, lævissima, nitida, viridia, margine pallidiori calloso integerrimo, basi dilatatâ decurrenti adnata. *Flores* in ramulorum apice terminales, capitati, monoici. *Amenta mascula* solitaria, sessilia, multiflora, laxa, foliis immutatis, squamisque (foliis mutatis) oblongis, obtusis, concavis, tenuissimè serrulatis, fulvis, conniventibus, margine scariosis involucrata: *axi* brevissimo, subulato, squamarum stipitum basibus persistentibus scabro. *Squamæ antheriferæ* longè unguiculatæ, subfastigiatæ: *ungue* lineari-angustissimo, compresso: *limbo* ovato-lanceolato, mucronulato, membranaceo, concavo, fulvo, margine scarioso. *Antherarum thecæ* 2, e baseos angulis squamarum limbi ortum ducentes, ovato-oblongæ, obtusæ, oppositè distantes, divaricato-patentes, ad periphæriam inferam rimâ bivalvi dehiscentibus: *valvulis* cum squamæ ipsius substantiâ continuis. *Amenta fœminea* solitaria, sessilia, multiflora, subrotundo-conica: *squamis* e pericarpio bracteâque conferruminatis? compositis, indefinitè numerosis, ovato-lanceolatis, acutis, planiusculis, coriaceis, imbricatis, regione placentiferâ protuberanti. *Ovula* 3, atropa, obcordata, complanata, spadicea, margine membranaceo-alata, apice foramine brevissimè tubuloso brunnescenti, ore aperto æquali prominulo instructa: *integumento* simplici. *Strobili* subrotundi, juglandis minoris magnitudine: *squamis* crassioribus, lignosis, haud peltatis, stipitatis, stipite crasso subtetragono, regione seminiferâ valdè incrassatâ, apice ovato, acuto, coriaceo, incumbente. *Semina* 3, v. sæpiùs tertio abortiente 2, ferruginea, margine altero (exteriore) dilatato alato, altero rectiore vix alato: *alá* e testæ epidermide tantùm constitutâ: *testa* tenuis, crustacea.

2. *A. cupressoides*, foliis ovatis obtusis adpressè 4-fariàm imbricatis, squamis antheriferis ellipticis obtusis.

Tab. XIII. Fig. 2.

Habitat in Tasmaniâ prope Launceston. *D. Gunn.* (n. 365 et 369). ♄. (v. s. sp. in Herb. Lindl.).

Arbuscula erecta, ramosissima, sempervirens. *Lignum* ut in præcedente, nisi quòd vasa quandoque duplici ordine punctorum notata. *Rami* conferti, cylindracei, facie *Cupressi torulosæ*, sed triplò crassiores. *Folia* creber-

rima, parva, adpressè 4-fariàm imbricata, ovata, obtusa, coriacea, lævissima, nitida, viridia, 1—2 lineas longa, hinc obsoletè carinata, inde concava, basi latâ adhærentia, margine perangusto scarioso. *Amenta mascula* in ramulorum apice solitaria, sessilia, laxè capitata, basi squamis (foliis mutatis) pluribus, oblongis, obtusissimis, inde concavis, margine scarioso-membranaceis involucrata. *Squamæ antheriferæ* pauciores et majores, ellipticæ, obtusæ, inde concavæ, rufescentes, margine membranaceæ: *ungue* angustè lineari, compresso. *Antherarum thecæ* 2, ovatæ, obtusæ, ad periphæriam inferam rimâ bivalvi dehiscentes. *Amenta fœminea* subrotundo-ovata, omninò ut in præcedente, sed squamæ pauciores et paullò latiores. *Strobili* duplò minores, subrotundi: *squamis* cuneato-lanceolatis, lignosis, stipitatis, regione placentiferâ maximè protuberanti, quasi subpeltatâ, trigonâ, superficie inæquali: *stipite* compresso-tetragono: *apice* triangulari-ovato, acuto, incumbenti.

The habit of this singular genus recalls to mind the *Lepidodendra*, those forms which at present exist only in a fossil state; the axis is studded with the persistent adherent bases of the leaves, resembling the lozenge-shaped marks on the stem of the fossil genus above-mentioned, and the ramification frequently presents a dichotomous appearance, which arises from the nondevelopment of one of the lateral branches, the normal arrangement being a primary axis with two opposite lateral branches. The bases of the leaves of *Lycopodiaceæ* being so completely continuous with the axis would not present such marks as those mentioned, and I am therefore inclined to consider *Lepidodendron* as allied rather to *Coniferæ* than to that family, and the interesting genus above described appears to present us with an evident link of connexion. I have not had an opportunity of examining the internal structure of *Lepidodendron*, but it is a subject well deserving investigation to ascertain whether the vessels composing its woody tissue present that uniformity and dotting which prevail throughout *Coniferæ*.

The female spike in *Athrotaxis*, unlike that of most of the other genera of *Cupressineæ*, forms a regular strobilus as in *Pinus*, and the scales are very thick, woody and persistent, as in the normal group of that genus. I have assumed that they are composed of a bracte and pericarpium, which are here completely

concrete, and by a comparison with the proper leaves, I think there can remain no doubt of their origin. The apex of the supposed concrete bracte is free, and in the mature cone overlaps the summit of the placentary region, which is situated on the inner surface of the scale, near its apex, and which at that period is found greatly enlarged. The rapid enlargement of the placentary region prevents the ovula, which are always situated on its under side, from assuming an erect position, and they are consequently obliged to take a downward direction; but in no case do they form any lateral adhesion with their axis, and there is consequently no raphe, and the foramen and point of attachment retain their original position; the ovula are, therefore, atropous; and the circumstance of the foramen occupying the lower extremity of the seed, arises from the ovula being forced to take a downward direction by the overhanging placenta. The hilum or point of attachment appears to be placed a little obliquely on the inner base of the seed from the extension of the winged border beyond it, which in this case consists of the cuticle merely and not of the entire substance of the testa. The testa in *Coniferæ* consists of a single integument only, the secondine of Mirbel, as Mr. Brown pointed out many years ago; and what I described as a second integument in *Pinus bracteata* and other species of the group of Silver Firs, is merely the cuticle of the nucleus, which in all these species is very conspicuous, and similarly winged like the proper testa, which by its open apex exhibits an analogy to the testa or cupula of *Taxus*.

The cotyledons in most *Coniferæ* are verticillate, and we therefore constantly observe a tendency to assume the same arrangement in the after leaves and other organs derived from them; but from the elongation and unequal development of the axis, the verticillate disposition is departed from, and they most frequently exhibit a spiral arrangement. A multitude of such spires in close contact, as happens in the branches of *Araucaria* and in the cones of *Pinus*, would of course give an indefinite appearance to the series; but in no case does the number of leaves in such a verticil exceed ten. In *Cupressus* the cotyledons are two and opposite, and we constantly find the after leaves opposite, the pairs crossing each other give to the leaves the appearance of being arranged in four rows. In *Callitris* the leaves are arranged in fours, as in *C. quadrivalvis* and *octovalvis*, and the pericarpial leaves

consist of a single verticil in the former, and two verticils in the latter, species; or they are disposed in threes, as in *C. Ventenatii*, and the pericarpia then consist of two verticils or six pieces. In *Pinus* and other genera, the verticillate arrangement is completely re-established at the nodi, or points where the elongation of the internodes ceases, as is seen by the buds or branches, although the leaves themselves, from whose axils they proceed, are often reduced to the condition of mere scales; and we may also remark, that the abortive branches of the Strobus tribe present a series of verticils of leaves, like the young seedling with its cotyledons. These facts, in my opinion, tend to overthrow the beautiful theory of the spiral development of the foliaceous organs, which has amused and puzzled the botanical world for some years past.

I regret that in the only mature seed of *Athrotaxis*, which I had an opportunity of examining, the embryo had been destroyed by some insect; but, from the leaves in *A. cupressoides* being in pairs, I conclude that the cotyledons are two, and that the fifth leaf of the spire in *A. selaginoides* is the first of the succeeding third pair.

As in many genera of *Coniferæ* the pericarpia are seen to differ but little, either in form or arrangement, from the ordinary leaves of the plant, we should expect to find a corresponding simplicity in the structure of the male organs. The scales, as they are usually termed, of the male spike I consider to be the antheræ, although they usually present a foliaceous character, and the thecæ as parts of a simple anther, a portion only of the subcutaneous cellular tissue being apparently converted into pollen. In the greater part of the genera of this family, such, for example, as *Cupressineæ* and *Taxineæ*, where the thecæ are arranged in a single series and situated at the external base of the scale, it would seem to be a portion of the under surface of the modified leaf that becomes transformed into pollen; and this is also the case in *Cunninghamia*. On the other hand, in *Dammara* and *Araucaria*, where the thecæ are numerous and disposed in a double series, a portion of both surfaces of the leaf may be supposed to be converted into pollen. On examining the scales or anthers at an early period, the masses of pollen will be found to present the appearance of small elevations occupying the lower base of the scale. At this period the raised portions of the cuticle present no suture or determinate line of dehiscence, although they are found to burst

in a regular manner on arriving at maturity. In *Athrotaxis* the lower edge of each side of the modified leaf assumes the condition of the cell of an ordinary anther; and here it is evident that both surfaces are employed in forming the cells, for their walls are continuous with the substance of the scale: but in the rest of the *Cupressineæ*, it would seem that the upper surface of the modified leaf or anther remains unchanged, and that a portion of the under surface only becomes polliniferous, the pollen occupying 2, 3, or 5 separate spots indicated by the raised and altered portions of the cuticle which cover them. These polliniferous thecæ are analogous to the subdivisions of the anthers of *Rhizophoreæ*, *Laurineæ*, &c., and are in all cases unilocular, and, as far as I have observed, destitute of any septum; their line of dehiscence is various, being sometimes in the direction of the axis, and sometimes contrary to it. I ought to except *Athrotaxis* and *Pinus*, in both of which the scales differ but little from the ordinary condition of the anther in other plants. My opinion of the scales being simple, and not originating from the confluence of several antheræ, is founded upon their resemblance to the bractes, and their transition through them to the proper leaves, from their nervation, which is entirely that of a simple leaf, exhibiting no traces of composition; and lastly, from their assuming in *Pinus* and *Athrotaxis* the ordinary condition of the simple anther. It may be worth noticing, that in *Athrotaxis selaginoides*, where the leaves are acuminate, the apex of the anther is also pointed; and in *A. cupressoides*, in which the leaves are obtuse, the anther is likewise blunt. The wood of *Athrotaxis* presents nothing unusual in its structure, but resembles that of *Cryptomeria*, except that the dots on the vessels are fewer.

I am indebted to my friend Dr. Lindley for the opportunity of giving figures and descriptions of both species of this curious genus, the specimens from which they were taken being contained in his rich herbarium, and having been sent to him, along with many other interesting plants, by Mr. Gunn, a zealous botanist, who is settled at Launceston in Van Diemen's Land. The drawings have been done under my inspection by my young friend Mr. Kippist, and they afford a good specimen of his success as a draughtsman.

The generic name alludes to the crowded disposition of the leaves and scales of the female spike, and is compounded of αθροος, *confertus*, and ταξις, *ordo*.

Since the preceding observations were in type, I have been favoured by my friend Mr. Smith, of the Royal Botanic Gardens at Kew, with a specimen of *Cunninghamia sinensis,* bearing several male catkins, and a full-grown cone. A careful examination of this remarkable plant has satisfied me that its proper place in a systematic arrangement is among the *Cupressineæ,* next to *Athrotaxis* and *Cryptomeria,* to both of whom it is related in a nearly equal degree. In the form, structure, insertion, direction, and number of its ovula it agrees entirely with the former genus, from which it is principally distinguished by its elongated aggregate male spikes, and by the addition of a third polliniferous theca. The placentary region is crowned with a thin, narrow, minutely toothed border, clearly of the same nature with the remarkable toothed organ, which I have described as the pericarpium in *Cryptomeria,* and which, singular as it is, can no longer be regarded in any other light than as an excessive development of the placentary region, and what I have described as a bracte is really the apex of the pericarpial leaf. The enlarged placentary region, and the erect ovula, are characters amply sufficient to separate *Cryptomeria* from *Cunninghamia,* in which the polliniferous thecæ are fewer, and altogether free. The striking resemblance, both in form and structure, of the antheriferous scales to those of the female spike, and also to the bractes and leaves, clearly show that they are all modifications of one and the same organ. In all the three genera abovementioned the antheriferous thecæ bear an evident relation to the number of the ovula, the latter apparently originating in all cases from the upper, and the former from the inferior surface of the modified leaf. The direction of the ovula, which in all cases are atropous, is evidently a character of no more than generic value in this family.

March 6, 1839.

EXPLANATION OF THE PLATES.

Tab. XIII.

Fig. 1. *Cryptomeria japonica.*

a. Antheriferous scale, front view, showing the five thecæ. *b.* Ditto, back view; both magnified. *c.* Scale of cone, with its bracte, back

R. Kippist del. *G. Jarman sc.*

view: natural size. *d.* Ditto, front view, showing the five ovula; magnified. *e.* Seed, separate; natural size. *f.* Ditto, magnified, showing the hilum at the base, and the tubular foramen at the apex.

Fig. 2. *Athrotaxis cupressoides.*

g. Rhachis of the male catkin, with two of the anthers; magnified. *h.* Scale of cone, back view. *i.* Ditto, side view; both natural size.

Tab. XIV.

Athrotaxis selaginoides.

a. Extremity of a branch bearing a male catkin; magnified. *b.* Antheriferous scale; magnified. *c.* Scale of cone; natural size. *d.* Ditto, with the three ovula; magnified. *e.* Seed; natural size. *f.* Ditto, showing the hilum at the upper, and the tubular foramen at the lower extremity; magnified.

IX. *Descriptions, &c. of the Insects collected by Captain* P. P. King, *R.N. F.R.S. & L.S. in the Survey of the Straits of Magellan. By* John Curtis, *Esq., F.L.S., &c.**

Read May 1st, 1838.

Order. Coleoptera.

Family. Carabidæ.

*1. Carabus suturalis. *Fab.*

A SPECIMEN agreeing with the Fabrician description was found at Port St. Elena; and a very fine variety, with the head, thorax, and elytra of a beautiful copper colour, was taken at Port Famine by Lieut. Graves. Mr. Miller informs me that many specimens of the *C. Chilensis*, Esch. have been met with under the bark of trees at Conception. These are the only species of *Carabus* found in South America that have come under my observation, and one of them departs considerably from the typical form.

2. Calosoma retusum. *Oliv., Fab.?*

Cape Gregory.

*3. Calosoma laterale. *Kirb.*

Maldonado in November. *Lieut. Graves.*

N. G. Cascellius. *Curt.*

Caput subparvum, ovatum. *Thorax* elongatus, obovatus, truncatus. *Elytra* magna, convexa, ovalia, basi angustata, apice rotundata. *Tibiæ anteriores* profundè emarginatæ, extùs denticulatæ. *Tarsi anteriores* in mare articulis tribus basalibus dilatatis obtrigonis: intermedii, præsertim in articulo basali subdilatati. *Antennæ* articulo 2do brevi, 1mo et 3tio æqualibus. *Palpi maxillares exteriores* articulo 2do longissimo, 3tio brevi, 4to

* Continued from p. 359, vol. xvii.—Those species with the asterisk attached are in the cabinets of Mr. Curtis.

crasso fusiformi; labiales articulo 3tio longo fusiformi crassiore 2do. *Mentum* trilobum, lobo medio trigono-truncato.

Labrum transverse, emarginate in front, with 6 long bristles (fig. 2.). *Mandibles* porrected, rather slender, elongate-trigonate, the apex curved and acute, with a small tooth on the inside below the middle (3.) *Maxillæ* long and slender, terminating in a sharp horny curved claw, the inside ciliated with rigid bristles. *Palpi*, internal biarticulate, basal joint a little the longest, 2nd rather the stoutest, curved and attenuated: external long, rather stout, and 4-jointed, basal joint short, 2nd the longest and stoutest, 3rd half as long, clavate, 4th not so long as the 2nd but as stout, fusiform, truncated but small at the apex (4.). *Mentum* transverse, not deeply emarginated, having a broad, subtrigonate tooth in the middle, truncated and scarcely concave at the apex, the side lobes rounded externally, the apex acuminated. *Labium* rather small and quadrate, apex concave, with 4 bristles. *Palpi* rather long, clavate and triarticulate; basal joint small, semi-globose, 2nd long and clavate, 3rd a little longer, stouter, and fusiform, the apex truncated (5.).

Antennæ shorter than the head and thorax, filiform, pubescent and 11-jointed, basal joint a little the stoutest, 2nd the shortest, 3rd as long as the 1st, 4th scarcely shorter, the remainder ovate and distinctly articulated (1.). *Head* narrow and ovate, trigonate before: *eyes* small, remote from the thorax, which is a little broader than the head, obovate, considerably elongated, truncated anteriorly and at the base, leaving a narrow collar behind: *scutellum* indistinct or concealed. *Elytra* nearly twice as broad as the thorax, ovate and convex, the apex rounded: *wings* none. *Legs* longish; anterior thighs and tibiæ stout, the latter deeply notched, with a long spine at the apex and another in the notch; *apex* externally denticulated, intermediate and posterior bristly, spurred at the apex, the latter slender and the longest: *tarsi* 5-jointed, anterior with the first 4 joints dilated in the male and obtrigonate (6.): 2 basal joints slightly dilated in the intermediate, all the dilated joints pubescent beneath: *claws* simple.

The habits and economy of some of the *Harpalidæ* approach so near to the

Scaritidæ that I have long considered they were closely connected*, and I think the insects before us confirm this view, for they are nearly related to *Broscus*, Panz., and equally so to my genus *Leiochiton*†. Never having seen the genus *Baripus*, Dej., I am unable to ascertain if it be allied to my group, but the masculine tarsi readily distinguish them.

*4. Cascellius Kingii. *Curt.*

Tab. XV. Fig. A.

Cupreo-viridis; elytris lineis punctorum undulatis, parùm impressis quasi reticulatis, nisi in lateribus deflexis; antennis pedibusque piceis, illarum articulo basali tibiisque ferrugineis.

Length 7½ lines; breadth 2¼.

Æneous with a coppery tinge down the middle, shining: *head* with faint lines in front: *thorax* convex, with a channel down the middle and two shallow foveæ at the posterior angles, which are a little rounded, sides with a narrow margin and a few punctures producing long hairs: *elytra* not thrice as long as the thorax, but broader, convex, the sides deflexed, forming an angular ridge parallel to the costa, on which there are 9 punctures: 9 waved shallow lines of punctures on each, portions of the alternate spaces between them smooth and dull, appearing reticulated: *basal joint* of antennæ and tibiæ ferruginous: *trophi* castaneous: *mandibles* and *labrum* blackish at the apex; *thighs* and *tarsi* piceous.

Two specimens of this beautiful species, which I have named in honour of Capt. P. P. King, were found in Chili.

*5. Cascellius Gravesii. *Curt.*

Tab. XV. Fig. B.

Piceo-nitens, suprà cupreus; elytris obsoletè striatis, lævibus, convexis; trophis, antennis, pedibusque ferrugineis; femoribus castaneis.

Length 5 lines; breadth 1¾.

* Vide my arrangement of the *Carabidæ* in the 2nd edition of the Guide.

† Brit. Ent. vol. viii. pl. 346: this seems to be Eschscholz's genus *Miscodera*, but whether he has ever published the characters I have never been able to learn: *Leiochiton* was established in 1831.

Very glossy, piceous inclining to castaneous: *head* and *thorax* greenish-black, the latter convex, cupreous on the disc, with a deep channel down the middle, the sides with a very narrow margin: *elytra* cupreous, the sides with green lines, twice as long as the thorax and perfectly convex, with shallow interrupted striæ, vanishing on the sides and apex, costa with a narrow margin, a foveolet at the base and 3 towards the apex; *trophi, antennæ* and *legs* ferruginous; *thighs* castaneous.

This species I have named after Lieut. T. Graves, to whom I am indebted for a pair: several were taken at Port St. Elena.

N. G. Cardiophthalmus. *Curt.*

Caput subangustum, ovatum. *Oculi* cordiformes. *Thorax* convexus, cordatus, truncatus. *Elytra* connata, lata, ovata, basi angustata, apice rotundata. *Femora anteriora* subtùs tuberculata. *Tibiæ anteriores* emarginatæ, spinis 2 longis validis armatæ. *Tarsi anteriores* articulato basali elongato et in mare paululùm dilatato, tribus sequentibus parvis, obtrigonis. *Antennæ* articulo basali crasso, 2do brevissimo, 3tio sequentibus longiore. *Palpi* articulis terminalibus ellipticis truncatis, duobus apicalibus æqualibus. *Mentum* non latè emarginatum, dente medio lato profundè emarginato.

Labrum transverse, slightly emarginate and ciliated (fig. 7 *l*). *Mandibles* porrected, strong, elongate-trigonate, the apex curved not acute (*m*). *Maxillæ* hooked at the apex, ciliated internally. *Palpi*, internal biarticulate; external 4-jointed, basal joint short, 2nd the longest, stout and curved, 3rd and 4th of equal length, the former clavate, the latter elliptic-truncate (*p*). *Mentum* with a rather deep and narrow notch, with a short tooth in the centre, broadly notched (8). *Palpi* triarticulate, basal joint short, 2nd long, 3rd as long, elliptic-truncate.

Antennæ shorter than the head and thorax, filiform, pubescent, slightly compressed, basal joint the stoutest, ovate, 2nd the smallest, 3rd as long as the 1st, 4th a little shorter than the 5th, which, as well as the following, is elongate-ovate (7 *a*). *Head* narrow and ovate (7); *eyes* rather small and cordate, remote from the thorax, which is much broader, convex,

obcordate-truncate, sides margined, base nearly straight, with a transverse channel, the angles rounded and notched, not covering the narrowed base of the abdomen: *scutellum* large and very flat, placed on the narrowed base of the abdomen. *Elytra* connate, much broader than the thorax, convex, elongate-ovate, the sides inflexed, forming a sharp narrow margin, apex rounded. *Legs* rather long, anterior the shortest and stoutest; *thighs* stout, anterior with 3 or 4 tubercles on the inside towards the base: *tibiæ*, anterior short and stout, notched and a little dilated, a very long spine on the notch and a longer one at the apex, which is pectinated; the other tibiæ bristly, with strong spurs at the apex and pectinated: *tarsi* not pubescent beneath, anterior with the basal joint the largest, being a little dilated externally, the 3 following obtrigonate: *claws* simple and rather slender.

6. Cardiophthalmus Clivinoides. *Curt.*

Tab. XV. Fig. C.

Lævis, niger; antennis brunneis; thorace porcâ transversâ basali; elytris indistinctè striatis, apice rugosis.

Length 9 lines; breadth $3\frac{1}{2}$.

Smooth black, *eyes* lurid: *thorax* with the anterior and hinder margins ciliated with ochreous hairs; a shallow transverse curved suture before and a deeper broad one parallel and close to the base, terminating in a slight fovea before reaching the angles; the extreme base is also depressed, forming a rounded ridge between it and the channel above; *longitudinal channel* shallow; *suture* a little depressed at the base; *elytra* with the striæ nearly obliterated, sutural stria abbreviated, the others most evident at the apex, which is rugose; a line of punctures along the margin. *Trophi* and *antennæ* ferruginous-brown, intermediate and hinder thighs with a row of deep punctures beneath.

If this be a male, it must belong to the *Scaritidæ*, as the tarsi are smooth beneath. It certainly bears a great resemblance to *Leiochiton*.

A single specimen was taken at Port Famine.

N. G. Odontoscelis.

Caput latum, ovatum: *oculi* parvi, à basi remoti. *Thorax* sublunatus: *scutellum* latum, triangulare. *Elytra* elongato-ovata, basi angustata, apice rotundata. *Tibiæ anteriores* emarginatæ, apice extùs in lobum longum productæ. *Tarsi anteriores* in mare dilatati, spinosi. *Antennæ* caput haud superantes; articulo basali reliquis crassiore, 2do subgloboso, 3tio clavato, sequentibus turbinatis paullò longiore. *Palpi maxillares exteriores,* articulo 3tio et 4to brevibus hoc elliptico truncato, reliquis crassiore; labiales articulis duobus apicalibus longioribus et gracilioribus. *Mentum* lobis duobus lateralibus magnis, lobo medio valido, conico.

Labrum transverse, emarginate and bristly, the sides ciliated (fig. 10 *l*). *Mandibles* porrected, robust, not very acute (*m*). *Maxillary palpi* with the 2nd joint a little the longest, 3rd and 4th of equal length, the latter a little the stoutest, elliptic-truncate, most convex externally (*p*). *Mentum* semiorbicular, narrowly emarginate with a long conical lobe in the centre (11). *Palpi* with the 2nd and 3rd joints long, the latter elliptic-truncate.

Antennæ not longer than the head including the mandibles, slender, 3 basal joints naked, 1st the stoutest, oval, 2nd the smallest, subglobose, 3rd scarcely so long as the 1st, the remainder turbinate, very much compressed and bristly, apical joint longer, and suddenly narrowed to the apex (*a*). *Head* broad and ovate (10): *eyes* small and oval, remote from the thorax, which is much broader than the head and lunate, being orbicular, with the anterior margin concave: *scutellum* forming a broad short triangle on the narrowed and uncovered base of the elytra, which are connate? not much broader than the thorax, convex, oval, margin inflexed, apex rounded. *Legs* stout: *thighs* short, incrassated and hairy: *tibiæ,* anterior short, very much dilated at the apex, the outer angle produced into a long curved lobe, with 2 strong spines, one at the base, the other at the apex of the notch, the intermediate and hinder tibiæ thickly clothed with short rigid bristles, especially externally, having strong spurs at the apex, which is pectinated: *tarsi* bristly beneath, anterior with the 3 first joints dilated and produced externally, fleshy beneath in

the male, basal joint elongated at the base, the 3 following semiorbicular, very bristly: *claws* rather short and strong (12, fore leg of male).

Obs. The female is broader than the male, and the lobe of the tibia is longer.

*7. ODONTOSCELIS TENTYRIOIDES. *Curt.*

TAB. XV. Fig. D.

Lævis niger; thoracis elytrorumque lateribus pilis aliquot longis, his obsoletissimè striatis, apicem versus sparsè punctatis.

Length $8\frac{1}{2}$ to $9\frac{1}{2}$ lines; breadth 3 to $3\frac{3}{4}$.

Smooth dullish-black, with long hairs over the eyes and the sides of the thorax, which latter is convex, with a narrow margin, the base a little concave, a very faint line down the middle terminating in a furcate impression behind: *elytra* with obscure striæ, the margin very narrow, with remote punctures producing long hairs, with a close line of punctures arising close to the margin at the shoulder but divaricating to the apex, where there are from 3 to 6 strong punctures producing bristles: *mouth*, tips of *palpi*, and underside of *tarsi* castaneous.

From Valparaiso. This insect has the habit of a *Percus*, but is distinguished by the simple tooth of the mentum; and it differs from *Broscus* in the proportions of the thorax and tibiæ. It appears to me to be nearly related to the *Scaritidæ*.

N. G. CYLLOSCELIS.

Caput latum: *oculi* parvi. *Thorax* subquadrato-cordatus. *Elytra* sublinearia. *Tibiæ anteriores* dilatatæ, parùm emarginatæ, aculeo apicali lato lanceolato; *posteriores* longiores, graciles, curvatæ. *Tarsi anteriores*, articulis 4 basalibus cordatis. *Antennæ caput* haud superantes; articulo basali reliquis longiore et crassiore, 3tio pyriformi, 2do 4to et sequentibus subobovatis. *Palpi maxillares exteriores*, articulo 3tio 2dum ferè æquante, 4to elongato, sublineari; *labiales* articulo 3tio longo, subfusiformi, truncato. *Mentum* dente medio trigono instructum.

Labrum slightly transverse, producing long bristles in front, a little emarginated. *Mandibles* strong, broad at the base, curved and acute (13*m*). *Maxillary palpi*, internal composed of 2 long slender joints, the 2nd at-

tenuated and curved, external with the 2nd joint stout, 3rd as long, but slender and clavate, 4th not so long, nearly linear and truncated (*p*). *Mentum* with a narrow and deep emargination, producing a triangular acute tooth in the middle (14); 2nd and 3rd joints of *palpi* nearly equal in length, the latter slightly attenuated at the base and apex, which latter is truncated.

Antennæ not longer than the head, slender, filiform and compressed, basal joint the longest and stoutest, 2nd obovate, 3rd subpyriform, 4th and following obovate, not longer than the 2nd, apical joint scarcely longer (*a*). *Head* somewhat ovate, broad at the base (13): *eyes* small ovate, not touching the thorax, which is broader than the head before, subcordate, a little broader than long, the sides with a slender margin, narrowed behind, the base a little convex, the angles obtuse, anterior margin slightly concave, leaving the angles a little projecting: *scutellum* triangular, nearly concealed by the thorax. *Elytra* a little broader than the thorax and more than twice as long, sublinear, the apex rounded and scarcely emarginated. *Legs* short, anterior stout: *tibiæ*, anterior short, dilated and compressed at the apex, slightly notched, spiny outside, with a broad lanceolate spine at the apex a little curved, and a larger one below it, more slender (15): *intermediate tibiæ* very spiny outside and ciliated internally, posterior longer and curved, with finer spines on both sides: *tarsi* very bristly, anterior slightly dilated, the 4 basal joints cordiform.

8. Cylloscelis ellipticus. *Curt.*

Ochreus; capite thoraceque ferrugineis, hoc foveis duabus longis basalibus; elytris pallidè fusco-æneis, minutè striatis.

Length $5\frac{2}{3}$ lines; breadth 2 lines.

Shining ochreous: *head* and *thorax* ferruginous, the latter convex and fuscous on the disc, with an elongated fovea on each side at the base, and a faint line down the middle: *mandibles* black at the apex: *antennæ* and *anterior tibiæ* subferruginous: *elytra* pale fuscous-æneous, costal margin ochreous, with 8 fine striæ on each, the 1st furcate at the base, the last sinuated and punctured at the base and apex.

A single specimen, which appears to be immature, was found at Gorrite. It seems to be allied to *Acinopus* and *Cratacanthus*, Dej., but the acute tooth of the mentum distinguishes it from the former, and the habit does not assimilate with the latter genus.

9. Pristonychus rufitarsis. *Curt.*

Piceus; antennis brunneis; illarum basibus, trophis, femorum basibus tarsisque castaneis; capite thoraceque nigris; elytris obscurè violaceis.

Length 7 lines; breadth $2\frac{1}{4}$.

Piceous: *antennæ* brown, 3 basal joints, trophi, coxæ, trochanters and tarsi castaneous: *head* and *thorax* bluish-black, the former with 2 foveæ in front, the latter with a deep channel down the middle, and a large fovea near each hinder angle: *elytra* dull violaceous, with fine striæ obscurely punctured, basal stria abbreviated, the costal deeply punctured, one or two punctures between the 3rd and 4th striæ on the disc.

A male from Conception.

10. Calathus Pennsylvanicus.

Oliv. vol. iii. *Gen.* 35. *p.* 72. *no.* 93. *pl.* 8. *f.* 92.

A female from Gorrite.

N. G. Metius. *Curt.*

Caput suborbiculare: *oculi* prominentes. *Thorax* subquadrato-cordatus: *scutellum* elytra separans. *Elytra* elliptica, apice obsoletè emarginata. *Tibiæ anteriores* parùm profundè emarginatæ: *tarsi anteriores* articulis 3bus basalibus in mare dilatatis, obovato-truncatis. *Antennæ* graciles, caput thoracemque æquantes; articulo basali reliquis crassiore, 2ndo haud brevi, 3tio et sequentibus longis. *Labrum* subprofundè emarginatum: *mandibulæ* breves, validæ. *Palpi* articulo apicali penultimo breviore, elliptico-truncato: *mentum* simplex, latè emarginatum.

Labrum slightly transverse, strongly emarginate, with a few bristles. *Mandibles* strong and curved. *Maxillary palpi* with the 3rd joint scarcely so long as the 2nd, 4th shorter, elliptic-truncate (16*p*): *labial palpi* with the 3rd joint shorter than the 2nd, and similar in size and form to the maxillary. *Mentum* with a broad notch, the centre slightly convex (17).

Antennæ as long as the head and thorax, slender, basal joint the stoutest, elliptic, 2nd not short, 3rd as long as the 1st, remainder nearly as long, the apical one a little longer (*a*).

Head suborbicular (16), narrowed behind the eyes, which are prominent and neither small nor remote from the thorax, which is much broader, slightly transverse and depressed, subquadrate, the sides convex before, the base straight, the angles acute: *scutellum* dividing the elytra, which are a little broader than the thorax, elongate-ovate, the apex slightly emarginate. *Wings* ample. *Legs* longish, thighs stout; *anterior tibiæ* not deeply notched, with a short thick spine at the apex and a longer one below, the others spiny outside, hairy within: *tarsi* hairy beneath, anterior with the 3 basal joints dilated and obovate-truncate in the male (18, a fore leg).

11. Metius Harpalioides. *Curt.*

Cœruleo-piceus, nitens; thorace foveis duabus basalibus, marginibus labroque ferrugineis; elytris obsoletè striatis; antennis, palpis pedibusque ochreis.

Length 4½ lines; breadth 2.

Shining piceous with a bluish tinge: *labrum* and *abdomen* ferruginous; *palpi, antennæ* and *legs* ochreous; *thorax* with a very faint line down the middle, and a large shallow fovea on each side of the base, the lateral and basal margins castaneous: *elytra* with faint punctured striæ, 1st abbreviated, and a line of strong punctures along the 9th.

A male from Port St. Elena.

12. Argutor dubius. *Curt.*

Niger, nitens; thorace utrinque ad basin sulco profundo foveolato; elytris minutè striatis, striâ primâ haud abbreviatâ; antennarum basi, palpis, tibiarum anticarum basi, tarsisque castaneis.

Length 4⅓; breadth 1¾ lines.

Shining black, clypeus indented on each side. *Thorax* quadrate, sides convex, a concave transverse impression in front, and a fine channel down the middle, base sparingly punctured, with a long oblique fovea on each side, with a deep channel at the bottom, the angles acute. *Elytra* emarginated at the apex, finely striated, the 1st not abbreviated but curved at

the base, a puncture on the disc upon the second stria, and several along the 8th; *antennæ* brown, base, palpi, base of anterior tibiæ and tarsi castaneous.

A female from Monte Video. The mentum has a very depressed conical lobe in the middle, which does not accord with that of *Argutor**; nevertheless it agrees so well in other respects that I cannot think they ought to be separated.

*13. Omaseus marginalis. *Curt.*

Niger, nitens; thorace foveis duabus simplicibus; elytris profundè striatis, costâ obscurè viridi.

Length 7; breadth $2\frac{1}{2}$ lines.

Shining black; *antennæ* fuscous, except at the base: *head* with 2 impressions in front: *thorax* quadrate-cordate, with a channel down the back, and a large deep fovea near each posterior angle, which is faintly punctured and almost acuminated. *Elytra* nearly thrice as long as the thorax, with deep striæ, the 1st abbreviated, 2nd and 3rd united at the base; 2 punctures on the 3rd stria below the middle, and another between the 3rd and 4th towards the base; the *costa* dull green, with punctures at the base and apex, which is rather strongly emarginate.

The lobe of the mentum is entire. This appears to be a common species in Valparaiso and Chili: my specimens I received from Mr. Miller.

14. Omaseus Nebrioides. *Curt.*

Niger, nitens; thorace foveis duabus medio profundioribus, basi multùm angustatis; elytris profundè striatis.

Length 6, breadth $2\frac{1}{4}$ lines.

Shining black: *antennæ* fuscous, except at the base: *head* with two impressions in front: *thorax* cordate-truncate, being narrowed at the base, where there are 2 foveæ, with a line at the bottom; the angles are acute and there is a channel down the back: *elytra* thrice as long as the thorax, with a yellowish tinge, deeply striated, 1st abbreviated, and and 3rd united at the base, 2 punctures below the middle on the 3rd and one towards

* Vide Curt. Brit. Ent. vol. xiv. pl. 666. f. 4.

the base on the 4th; a line of punctures near the costa, thickest at the base and apex, which is strongly emarginated.

From Chili. It has somewhat the habit of an *Helobia**, and the lobe of the mentum is simple.

15. Pterostichus lucidus. *Curt.*

Niger, viridi-nitens; pedibus subcastaneis; femoribus piceis.

Length 5, breadth $1\frac{3}{4}$ lines.

Shining, black with a greenish gloss: *head* with two impressions in front. *Thorax* cordate-truncate, with a lunate impression in front, a channel down the back, a deepish simple fovea near each angle, which is transversely vermiculated and acute. *Elytra* not thrice as long as the thorax, finely striated, 1st abbreviated, 2nd and 3rd united near to the base, the former curved, 2 punctures below the middle on the 3rd and 1 towards the base of the 4th; *costa* deeply punctured at the base and beyond the middle, apex emarginate. *Legs* subcastaneous, thighs piceous.

A male from Valparaiso. The lobe of the mentum is simple.

*16. Pterostichus rufipalpis. *Curt.*

Niger, nitens; palpis ferrugineis: thorace subelongato-cordato; elytris elongato-ovatis, striatis.

Length $5\frac{3}{4}$, breadth 2 lines.

Black, shining: *palpi* ferruginous: *head* with 2 lines in front. *Thorax* appearing longer than broad, convex, cordate-truncate, considerably narrowed at the base, angles acute, with a long simple fovea; a channel down the back: *elytra* nearly thrice as long as the thorax, elongate-ovate, finely striated, 1st stria very short, 2nd and 3rd united at the base, 2 or 3 punctures between the 3rd and 4th, with a line of very large ones along the costa, the apex emarginate: *legs* piceous.

A pair from Chili. It has a little the habit of a *Steropus*.

*17. Pterostichus prasinus. *Curt.*

Piceus; capite thoraceque cœruleo-viridibus; elytris pulchrè viridibus, ad latera quandoque flavescentibus.

Length $4\frac{1}{4}$, breadth $1\frac{2}{3}$ lines.

* Vide Curt. Brit. Ent. vol. v. pl. 103.

Piceous: *head* and *thorax* blue-green or violaceous; *elytra* bright green, sometimes yellowish round the sides. *Thorax* cordate-quadrate, slightly transverse, base not contracted, with a simple fovea near each angle, which is not acute, a channel down the back; *elytra* more than twice as long as the thorax, scarcely broader and ovate, a sharp stria down each side of the suture, the others punctate, but nearly obliterated, excepting the 2 costal, on which there are deep punctures, a puncture near the base of the 3rd stria, a 2nd below the middle, and another towards the apex: *palpi*, base and apex of *antennæ* and *tarsi* ferruginous.

This handsome species from Conception has so much the habit of an *Harpalus*, that if it were not for the tarsi I should have considered it as such. The lobe of the mentum is emarginate.

18. ANTARCTIA CIRCUMFUSA. *Germ.*

A single specimen from Gorrite.

*19. ANTARCTIA MARGINATA. *Dej. Spec. des Coléopt. vol.* iii. *p.* 532.

One specimen from Conception.

*20. ANTARCTIA ANNULICORNIS. *Curt.*

Nitens, obscurè viridis, cupreo tincta; thoracis margine, antennis pedibusque saturatè ochreis; antennarum articulis 2do, 3tio, 4toque femoribus, tarsisque piceis.

Length $4\frac{1}{3}$ to 5 lines; breadth $1\frac{3}{4}$ to 2 lines.

Shining and of a rather dull green; *palpi*, *antennæ* and *legs* dark ochreous, 2nd, 3rd and 4th joints of *antennæ* black, thighs and hinder *tarsi* piceous: *thorax* a little transverse, the sides very convex, with a fine ferruginous margin, a channel down the back, simple foveæ at the hinder angles, which are somewhat rounded, the base being oblique on the sides: *elytra* much broader than the thorax, and full thrice as long, the apex emarginate, often with a cupreous tinge, striæ very fine and punctured, 1st long but abbreviated. *Wings* ample. All the tarsi are sometimes pitchy, the base of the joints and the apex of the last being ochreous.

This has a good deal the habit of an *Agonum*, and is nearly allied to the following, which seems, however, to have a narrower thorax. Lieut. Graves found it not uncommon at Port Famine in January, February, and March.

21. Antarctia latigastrica. *Esch.*

From Port Famine.

*22. Selenophorus variabilis. *Curt.*

Niger, suprà violaceus vel viridis, minutè punctulatus; labri margine, palpis tarsorumque apicibus ferrugineis; thorace subquadrato, angulis posticis rotundatis, foveis binis; elytris profundè striatis, interstitiis convexis.

Length 6, breadth $2\frac{2}{3}$ lines.

Black shining, opalescent-violaceous, sometimes green above, irregularly pitted: *antennæ* brown, base piceous: margins of *labrum*, *palpi*, and tips of *tarsi* ferruginous: *head* broad, 2 impressions between the eyes. *Thorax* broad and depressed, a channel on the disc, two long foveæ near the angles, which are rounded, the base being convex on each side and straight in the middle. *Elytra* broad, more than twice the length of the thorax, deeply striated, the interstices convex, an oblique broken stria at the base between the 1st and 2nd; *apex* slightly emarginate, with a line of strong punctures and a few at the base near the costa.

From St. Paul's. I have also a specimen from Brazil which was green above, but on being made damp in order to relax it, it became nearly black. It has somewhat the habit of *Pœcilus cupreus.*

*23. Harpalus lævis. *Curt.*

Lævis, niger; palpis antennisque fulvis; pedibus piceis; thorace anticè paululùm angustato, angulis rotundatis, foveis simplicibus; elytris tenuitèr striatis.

Length $4\frac{1}{2}$, breadth $1\frac{3}{4}$ lines.

Smooth shining black; *palpi* and *antennæ* ferruginous; *legs* pitchy; *thorax* slightly transverse-quadrate, a little narrowed anteriorly, angles rounded, foveæ simple, elytra finely striated, 1st stria furcate at the base; a punc-

ture between the 2nd and 3rd towards the base, a 2nd before the middle, and a 3rd towards the apex, which is slightly emarginate.

In one specimen the elytra have a slight dull green tinge: it is considerably like what I take to be the *H. tardus*, Ill., and was found at Port St. Elena and Conception.

*24. Harpalus cupripennis. *Germ. Col. Nov. Spec. p. 16. no. 25.*

The 2nd and 3rd joints of the antennæ are sometimes piceous, and all the others pale ferruginous. It was abundant at Gorrite and at Maldonado in November. *Lieut. Graves.*

Family. DYTICIDÆ.

25. Colymbetes? angusticollis. *Curt.*

Tab. XV. Fig. E.

Ochreus; oculis, capite, clypeo excepto, scutello subtùsque nigris; thorace angusto; elytris longissimis, nigro-lineatis reticulatisque.

Length 4½, breadth 2 lines.

Ochreous, shining: *head* and *eyes* black, leaving a semiorbicular ochreous space on the clypeus: *thorax* short, a little broader than the head, transverse-oblong, a line of punctures before and behind near to the margins, a short channel on the disc, sides a little depressed: *scutel* piceous. *Elytra* nearly twice as broad as the thorax at the base, and seven times as long, elliptical, apex truncated a little obliquely; some scattered punctures in lines, a short black streak on each side of the scutellum, 3 long ones down the disc, and 2 or 3 oblique ones on the sides; the spaces between somewhat reticulated with black, leaving a broad marginal space free: underside piceous.

A male from Port St. Elena. The narrow thorax and very long elytra depart so far from the typical form of *Colymbetes*, that I have little doubt of this being a good genus; but as I have no specimen to dissect I have not ventured to establish it as such.

Family. GYRINIDÆ.

*26. Epinectus sulcatus. *Wied.*

Rio de Janeiro.

*27. Gyrinus Leathesii. *Curt.*

Convexus, ovalis, olivaceus; labri basi, orbitis, thoracis marginibus elytrisque aureo-viridibus, his lineis punctorum obsoletorum cupreis; subtùs pedibusque castaneis.

Length 5, breadth $2\frac{2}{3}$ lines.

Oval, convex, smooth, shining olivaceous brown with a greener hue in parts; base of *labrum*, orbits of *eyes*, and lateral margins of *thorax* and *elytra* aureous green: *head* and *thorax* variegated with cupreous; base of *thorax* and 8 obscurely-punctured lines down each elytron cupreous, a semicircular depression at the apex of the abdomen, which is exposed, punctured and pubescent: *anterior legs* rather short and stout: underside piceous, variegated with castaneous; *palpi*, *legs*, and inflected margins of *thorax* and *elytra* castaneous.

This seems to be abundant at Valparaiso. I have named it after the late Rev. G. R. Leathes, who also received it from thence and gave me specimens.

Family. STAPHYLINIDÆ.

28. Ocypus scabrosus. *Curt.*

Obscurè niger, densè et minutè punctatus, villosusque; palpis, antennis, pedibus, femoribus exceptis, abdomineque apice castaneis.

Length 8, breadth 2 lines.

Dull black, excessively thickly and minutely punctured and clothed with short depressed hairs: *head* not broader than the thorax, edge of clypeus ochreous, margins of *labrum* orange, *mentum* straw-colour, *palpi* and *antennæ* castaneous; *scutellum* velvety-black: *legs*, excepting the thighs, and apex of abdomen, castaneous, pubescence inside of the anterior tibiæ and under the tarsi bright ochreous or golden.

A male from Gorrite.

Family. BUPRESTIDÆ.

*29. Psiloptera cupro-ænea? *Humb. et Bonpl. p.* 49. *pl.* 33. *f.* 5.
From Valparaiso.

Family. ELATERIDÆ.

30. Pyrophorus lucifugus. *Curt.*

Brunneus, densè et minutè punctatus, pubescensque: antennis breviusculis, compressis cum pedibus *rufescenti-brunneis*; thorace convexo, subquadrato, maculis duabus basalibus rotundis luminosis; elytris haud attenuatis.

Length $9\frac{1}{2}$, breadth $2\frac{2}{3}$ lines.

Brown, pubescent, thickly and minutely punctured: *head* not broad: *thorax* convex, subquadrate with a perfectly round yellow spot at each of the basal angles, the hinder margins ferruginous: *elytra* very long, not attenuated but rounded at the apex, densely clothed with brown pubescence, the punctate striæ distinct: *antennæ* linear, compressed, not longer than the thorax, light reddish-brown as well as the legs.

From Gorrite. The breadth of the elytra towards the apex distinguishes this from *E. luminosus,* Ill.

*31. Chalcolepidus porcatus. *Fab.*
From Rio de Janeiro.

32. Æolus? variegatus. *Curt.*

Ochreus; oculis, thoracis marginibus lateralibus posticè, lineâque dorsali nigrescentibus; elytris apice bispinosis; maculâ scutelli utrinque, annulisque duobus subovatis ponè medium piceis.

Length 4 lines, breadth 1.

Labrum vertical; *trophi* concealed; *antennæ* with the 2nd and 3rd joints not much shorter than the following. Ferruginous-ochre, thickly and minutely punctured, and clothed with short ochreous pubescence. *Thorax* quadrate-ovate, nearly linear, basal angles not long; a dorsal line, the lateral margins posteriorly, and the eyes blackish. *Elytra* ochreous,

punctate-striate, apex emarginate, forming 2 strong blackish spines on the outside; a spot on each side of the scutellum piceous, a band across the middle and another below it, uniting along the suture and costa, and forming 2 ovals of a piceous colour: *legs* pale ochre.

One from St. Paul's. It seems to be nearly related to Germar's *E. subfasciatus.*

*33. AMPEDUS? DORSALIS. *Curt.*

Niger, puberulus; capite thoraceque profundè punctatis; thoracis marginibus lateralibus ochreis; elytris minutè punctatis, striis profundè punctatis, maculâque magnâ ochreâ humerali secus costam attenuatâ.

Length $6\frac{2}{3}$, breadth 2 lines.

Terminal joint of *maxillary palpi* subtrigonate: *antennæ* with the 2nd joint globose, 3rd short obovate, the remainder compressed, serrated. Black, pubescence ochreous; *head* and *thorax* thickly and strongly punctured, the latter ovate-quadrate, the angles long, acute, and piceous at the apex, a broad lateral ochreous margin, extending also beneath, and leaving an oval black space on the back: *elytra* rounded at the apex, minutely punctured, with strongly punctured striæ, a large bright ochreous spot covering each shoulder, and attenuated along the costa beyond the middle.

Taken by Lieut. T. Graves.

*34. AMPEDUS CINGULUM. *Curt.*

Niger; capite thoraceque densè, elytris minutè punctatis; his lineis punctorum magnorum non nisi ad apicem et in maculâ unâ alterâve disci ochreis.

Length 6 to 7 lines, breadth 2 to $2\frac{1}{2}$.

Palpi and *antennæ* like *A. dorsalis,* excepting the 3rd joint of the latter, which is subglobose. Black, pubescent; *head* and *thorax* thickly and strongly punctured, the latter suborbicular, the hinder lobes long, divaricating and acute, slightly gibbose behind, with a dorsal impression: *elytra* bright ochreous, excepting a large portion of the apex, minutely punctured, with very strong lines also of brown punctures, 2 piceous spots on the disc placed obliquely, the upper ones next the suture are sometimes wanting.

From St. Paul's.

Family. CEBRIONIDÆ.

*35. Rhipicera marginata. *Lat.*

From Rio de Janeiro.

*36. Rhipicera femorata. *Dalm.*

From Gorrite and Rio de Janeiro.

*37. Rhipicera cyanea. *Guer. Icon. pl.* 13.

A female from Rio, I believe.

38. Cyphon Patagonicum. *Curt.*

Ochreo-nitens, densè minutèque *punctatus*; antennis nisi in articulo basali maculis duabus facialibus thoracisque disco fuscis.

Length $2\frac{1}{4}$ lines, breadth $1\frac{1}{3}$.

Shining ochreous, thickly and minutely punctured; *antennæ* fuscous, excepting the basal joint and the tips of the others; 2 spots on the face and the disc of the thorax fuscous, the latter broader than the head and narrower than the elytra, semiorbicular; beneath brownish; a line of black spots down each side, and a double row of smaller ones down the middle.

A single specimen from Port St. Elena. It is considerably like *C. livida*, Fab., but it is narrower.

Family. LAMPYRIDÆ.

*39. Amydetes plumicornis. *Lat. Humb. & Bonpl. pl.* 16. *f.* 4.

A male from Rio.

40. Nyctophanes maculata. *Fab. Oliv. vol.* iii.; *Gen.* 28. *pl.* 1. *f.* 3.

From Gorrite.

*41. Lampyris diaphana. *Germ. p.* 64. 104.

Gorrite and Monte Video.

42. Lampyris angustilimba. *Curt.*

Fusca; thoracis margine ochreo-brunneo, maculis duabus partem anticam

versus obliquis, ovatis, ochreis; suturæ marginibus strigâ costali lanceolatâ, abdominisque segmentis 5to 6toque pariter ochreis.

Length 11, breadth 4 lines.

Brown, clothed with exceedingly short ochreous pubescence, and minutely and thickly punctured: *antennæ* a little longer than the thorax, filiform, compressed; *head* concealed, *eyes* large, *thorax* semiovate, with a broad ochreous-brown margin, slightly reflexed, with a line of punctures quite round, an oblique ochreous oval spot on each side in front, the space between them brown, with an elevated line in the middle: *elytra* linear, nearly 4 times as long as the thorax, with 2 or 3 slightly elevated striæ, the margin reflexed and slightly dilated towards the base, a fine sutural margin and a lanceolate vitta close to the costa but not touching it, ochreous; 5th and 6th abdominal segments ochreous-white beneath: *trochanters* and *knees* slightly ochreous.

One from St. Paul's.

43. Lampyris Luna. *Curt.*

Fusca; thoracis margine, maculis duabus parallelis partem anticam versus, suturæ costæque marginibus, abdominisque segmentis 5to 6toque stramineis.

Length $6\frac{1}{2}$, breadth $2\frac{3}{4}$ lines.

Pale brown, edge of thorax and 2 oval parallel spots in front straw-colour, with a broad brown flat space between them, a narrow margin to the suture and a lanceolate one the whole length of the costa, as well as the 5th and 6th abdominal segments beneath, of the same colour.

Very similar to *L. angustilimba*; the form of the spots on the thorax, and the pale stripe which covers the costa, distinguish it. From St. Catherine's

*44. Lampyris fenestralis. *Curt.*

Saturatè brunnea; antennis flabellatis; thorace maculis duabus commatiformibus partem anticam versus; vittâ subcostali, abdominisque apice ochreis.

Length 7, breadth 3 lines.

Similar in contour to the former species. *Antennæ* with the 3rd and following joints producing a long rounded lobe internally: *thorax* with 2 ochre-

ous inverted comma-shaped marks in front; *elytra* with a long pale ochreous lanceolate stripe near the costa, not touching the base nor reaching the apex; *abdomen* ochreous-white at the apex.

From St. Paul's.

*45. Photuris? femoralis. *Curt.*

Fusco-ochrea; capite antennisque piceis; thorace scutelloque ochreis; elytrorum marginibus pallidis, abdominisque segmentis 5to 6toque albidis; pedibus fuscis; femoribus ad basin rufis.

Length 6, breadth 2 lines.

Fuscous-ochre, shining, minutely punctured and pubescent; *head* and *antennæ* piceous; *thorax* semiorbicular, with broad margins, the base sinuated, the angles slightly lobed, ochreous as well as the scutellum, *suture* and margin of *elytra* somewhat ochreous: *legs* brown, *thighs* bright ochre, excepting the apex: 5th and 6th *abdominal segments* ochreous-white beneath.

The drooping head, large eyes, shield-formed thorax, and phosphoric segments of the abdomen indicate an affinity to the *Lampyrides*, but it is in habit a *Telephorus*. I have many species, all agreeing in the above characters with this from Rio, which I imagine belong to Dejean's genus *Photuris*.

*46. Callianthia fallax. *Ill.*

From St. Paul's: this seems to be one of the most common and variable species in Brazil.

*47. Callianthia flavipes. *Fab.*

Fabricius gives China as the country which this species inhabits; but I think this specimen from St. Catherine's is unquestionably a variety only of his insect.

*48. Telephorus rubromarginatus. *Curt.*

Cœruleo-niger; thoracis margine basali ad angulum utrumque maculâ pulchrè rubrâ terminatâ.

Length 4 lines, breadth 1½.

Black, bluish above, pubescent; *thorax* shining, transverse-oblong, the angles

rounded, lateral margins sharply reflexed behind, with a bright red spot on each side, the same colour continued along the base in a narrow margin.

Not uncommon at Port Famine.

*49. Telephorus Diadema. *Fab.*

From St. Paul's.

50. Telephorus biguttatus. *Curt.*

Obscurè-niger; antennarum articulo basali subtùs, mandibulis, maculisque duabus thoracis reniformibus flavescentibus.

Length 4 lines, breadth $1\frac{1}{4}$.

Dull black, finely pubescent and punctured; basal joint of *antennæ* beneath and *mandibles* pale ochreous: *thorax* transverse ovate, sides reflexed, with 2 large reniform pale yellow spots on each side of the disc, the underside, excepting the margin, of the same colour.

One from Chili.

Family. MELYRIDÆ.

*51. Dasytes lineatus. *Fab.*

Common at Rio.

52. Dasytes lineatipes. *Curt.*

Virescenti-niger; pilis ochreis nigrisque vestitus; pedibus ferrugineis; femoribus strigis duabus nigris.

Length 2 lines, breadth 1.

Greenish-black, thickly and coarsely punctured, clothed with depressed ochreous hairs and longer black erect ones: *legs* ferruginous, *thighs* with a black stripe above and another beneath.

A specimen from Valparaiso, wanting the antennæ.

53. Dasytes glaber. *Curt.*

Lævis, æneo-niger; capite thoraceque profundè, elytris minutè punctatis.

Length $1\frac{1}{2}$ line, breadth $\frac{3}{4}$.

Smooth, æneous-black: *antennæ* clavate; *head* and *thorax* strongly punctured, the latter depressed, subquadrate: *elytra* minutely punctured and exceedingly finely pubescent.

One from Conception.

Family. CLERIDÆ.

*54. Necrobia rufipes. *Fab.*

A blue variety of this species was common at Gorrite: indeed it seems to be found all over the world.

I may here observe that I have seen only *one* species of *Corynetes**, which is the *violaceus* of Fabricius; it is the type of his genus, and is distinguished by 5-jointed tarsi and a linear club of 3 nearly equal joints, whereas **Necrobia rufipes* and its congeners have 4-jointed tarsi and an obovate club of 3 joints, the terminal one being very large, and the palpi are different; notwithstanding which the Baron Dejean includes them all in one genus under the name of *Corynetes*.

N. G. Exops. *Curt.*

Caput latum: *oculi* parvi, valdè prominentes. *Mandibulæ* porrectæ, alterâ bifidâ utrâque intùs profundè emarginatâ. *Maxillarum lobus internus* latior. *Palpi* 4- et 3-articulati, articulo terminali gracili, subfusiformi. *Mentum* profundè emarginatum. *Antennæ* 11-articulatæ, articulo 3tio, reliquis breviore, articulis tribus terminalibus clavam laxam compressam efformantibus. *Tibiæ anticæ* extùs denticulatæ; *tarsi* graciles, 5-articulati, articulo basali brevi, secundo reliquis longiore.

Labrum transverse, a little narrowed before and rounded, slightly emarginate and densely ciliated with long hairs. *Mandibles* porrected, stout and trigonate, one bifid at the apex, both with a deep notch at the middle (19*m*). *Maxillæ* with a harp-shaped internal lobe, and a linear ovate external one, both ciliated. *Palpi* rather long and 4-jointed, clothed with long hairs, basal joint short and slender, 2nd and 3rd of equal length, stoutish and clavate, 4th as long but slenderer, elliptic-ovate, the apex truncated. *Mentum* transverse, subtrigonate, deeply emarginate.

* Vide vol. vii. fol. and pl. 350 and 351 of Curt. Brit. Ent., where dissections and the characters are laid down.

Palpi short, triarticulate, basal joint the shortest, 2nd clavate, ciliated with very long hairs inside and at the apex, 3rd nearly as long, slender, elliptic-ovate, a little truncated. *Labium* bilobed.

Antennæ not longer than the head, clavate, compressed, pilose, 11-jointed, basal joint ovate, 2nd subglobose, 3rd minute, 5 following subovate, decreasing in length, the remainder forming a loose club, 9th and 10th obovate-truncate, 11th ovate, slightly truncated (*a*). *Head* large, subquadrate (19): *eyes* small but very prominent, and projecting beyond the thorax, which is obovate-truncate: *scutel* small. *Elytra* broader than the thorax and more than 4 times as long, convex, apex rounded. *Wings* very ample. *Legs* rather short: anterior stout (20): *tibiæ*, anterior short, compressed, denticulated externally, with 2 short spines at the apex, one hooked: *tarsi* slender, 5-jointed: basal joint small, 2nd the longest, 4th obovate; *claws* simple acute.

The deeply notched mandibles, denticulated anterior tibiæ, small basal joint of tarsi, which are slender, and minute 3rd joint of antennæ, characterize this genus. It seems to be allied to *Thanasimus** in habit, but the antennæ are most like those of *Corynetes*†.

*55. Exops Bevani. *Curt.*

Tab. XV. Fig. F.

Piceus, pilosus, punctatus; capite granulato; antennis subferrugineis.
Length $6\frac{1}{2}$ to 10 lines; breadth 2 to 3 lines.

Shining piceous, with fine long hairs, especially on the head and thorax; *palpi* and *antennæ* ferruginous; *head* coarsely granulated: *thorax* minutely punctured: *elytra* sparingly punctured, inclining to castaneous as well as the legs: underside pubescent.

The relative size of the head varies considerably in this species, several of which were taken at Valparaiso, from whence also it was received by Robert Bevan, Esq., to whom I have the pleasure of dedicating it.

* Curt. Brit. Ent. fol. and pl. 398. † Ib. 351.

EXPLANATION OF TAB. XV.

Fig. A. *Cascellius Kingii.*

B. ——— *Gravesii.*

1. Antenna. 2. Labrum. 3. Mandible. 4. Maxilla. 5. Mentum. 6. Fore-leg.

C. *Cardiophthalmus Clivinoides.*

7. Head. *a.* Antenna. *l.* Labrum. *m.* Maxilla. *p.* Palpi. 8. Mentum. 9. Fore-leg.

D. *Odontoscelis Tentyrioides.*

10. Head. *a.* Antenna. *l.* Labrum. *m.* Mandible. *p.* Palpi. 11. Mentum. 12. Fore-leg.

13. *Cylloscelis ellipticus.* *a.* Antenna. *l.* Labrum. *m.* Mandible. *p.* Palpi. 14. Mentum. 15. Fore-leg.

16. *Metius Harpalioides.* *a.* Antenna. *p.* Palpi. 17. Mentum. 18. Fore-leg.

E. *Colymbetes angusticollis.*

F. *Exops Bevani.*

19. Head. *a.* Antenna. *m.* Mandibles. 20. Fore-leg.

Obs. The lines by the sides of the Insects in the Plate denote their lengths in nature.

X. *Description of the* Mora Tree. *By Mr.* Robert H. Schomburgk. *Communicated by* George Bentham, *Esq. F.L.S.*

Read March 20th, 1838.

Prominent among the trees which adorn the forests of Guiana, and which astonish by their profuse verdure and gigantic size, stands the majestic *Mora*, the king of the forest. Rising to the height of from sixty to ninety feet before it gives out its branches, it towers over the wall-like vegetation which skirts the banks of the rivers of Guiana, forming a crown of the most splendid foliage, overshadowing numerous minor trees and bushes, and hung with Lianas in the form of natural festoons. The trunk, rugged and clothed with epiphytes, juts towards the base into tabular buttresses or excrescences (resembling in that property the silk-cotton tree, *Bombax Ceiba*). These buttresses are subjected to an early decay, and they sometimes form a cavern, which would afford room and protection against the inclemency of the weather to several persons; and I have often wondered, when I considered the heavy mass which these half-decayed excrescences had to support, how they were able to withstand the tornado that so frequently sweeps through the forest, shaking the crown like a reed.

The *Mora*, of all other trees of the forests of Guiana, is peculiarly adapted for naval architecture; and it is to be found in such abundance, that if once introduced for building material into the dock-yards, there can never be any apprehension that there would be a want of that timber which could not be supplied. The wood is uncommonly close-grained, and gives scarcely room for a nail when driven into it: when clear of sap, it is durable in any situation whether in or out of the water.

With this property it unites another of equal consideration to builders; it is strong, tough, and not liable to split, and has never been known to be subjected to dry rot, and is considered, therefore, by the most competent judges to be

superior to oak and African teak, and to vie in every respect with Indian teak. The full-grown tree will furnish logs from thirty to forty, or even fifty feet in length, and from twelve to twenty-four inches square, taken from the main stem; whilst the other parts would cut into the most choice and valuable pieces in request for naval architecture; such, for instance, as keels, keelsons, stem-posts, floors, ribs, beams, knees, breasts, backs, and others.

During my researches in the interior of British Guiana, I found many a Mora tree which astonished me by its gigantic size; but I was never more surprized than by one which I found by the river Berbice, in lat. 4° 40′ N., being then in pursuit of a flock of wild hogs. Circumstances then did not permit me to give it more than a cursory glance; but I determined, if I should pass again on my descent this remarkable tree, to measure the proportions of this giant of its kind. I did not forget my resolution, and on my descent of the river Berbice in February, 1837, I lost no time in executing my design. The height of the trunk and its branches were ascertained by measuring a small base line, and by taking the angles of altitude by a sextant. The other parts were measured by one of Gunter's chains. The tree was not so remarkable for its height, but the tabular buttresses were of an uncommon size, and so completely decayed in the centre as to represent a wooden cavern, upwards of sixteen feet high, which would have afforded room for fifteen persons, without exposing them to the influence of the weather. The height of the tree from the ground to the top branches was ascertained to be 93½ feet English; the height of the trunk from the ground to the first branches, 63½ feet; the circumference of the tabular excrescences, 71½; their largest diameter 38 feet; their smallest 12 feet; the height of the buttresses from the ground to where the trunk adopts a more regular form, 20½ feet; the circumference of the trunk being there 21 feet.

The Mora, interesting at all periods in its appearance, presents the most pleasing aspect during the period it is in flower; the beautiful dark green of its leaves, contrasts so well with its snow-white blossoms, that I am sure it would be impossible to pass it without admiration, even if it had no other qualifications to recommend itself.

Dr. Hancock, in his pamphlet on British Guiana, represents the Mora as belonging to the genus *Mimosa*; but I conclude from his statement that he

never inspected the flowers of that tree, or he would have found that, though resembling some of the *Mimoseæ*, it forms one of the *Cassieæ* of De Candolle. The absence of authentic references prevents me from describing it; but I hope that this want will be supplied by a more competent botanist before this account is laid before the Linnean Society.

Additional Observations by George Bentham, *Esq. F.L.S.*

From the specimens transmitted by Mr. Schomburgk, it appears that the Mora forms a new genus belonging to the order *Leguminosæ*, and to the tribe *Cassieæ* of De Candolle. Its nearest affinities are with *Tachigalia* of Aublet, and *Leptolobium* of Vogel*; but it differs from both in the woody texture of the pod, which is, moreover, naturally dehiscent, in the greater regularity of the floral parts, and in the sterility of the alternate stamina.

The Mora belongs to the series of genera which, as observed by Vogel, connect the *Sophoreæ* with the *Cassieæ*, a circumstance to which I also adverted in my memoir, inserted in the Vienna Annals†. Mr. Vogel gives to the group the name of *Sebipireæ*, and considers it as a section of the *Cassieæ* or *Cæsalpineæ*. He has, however, correctly shown that the direction of the radicle cannot be made use of as an absolute character to separate the *Sophoreæ* from the *Cassieæ*, and the only remaining distinction lies in the papilionaceous corolla of the former; and this arrangement is certainly more distinct in *Bowdichia* (the same genus as *Sebipira*), which he takes as the type of the section of *Cassieæ*, than in *Ormosia*, which he leaves among *Sophoreæ*. It is true, that the passage from the perfect papilionaceus corolla of *Sophora*, to the regular one of Mora, is gradual; but it appears to me that the line of distinction would be much more naturally drawn between *Bowdichia*, *Ormosia*, and *Di-*

* At the time Vogel published this genus in the Linnaea (vol. xi. p. 388.), my memoir on some genera of *Leguminosæ* in the Annals of the Vienna Museum was already in print; and I had there established a genus of *Phaseoleæ* under the same name: but as Mr. Vogel's paper has the priority of publication, the name of my genus of *Phaseoleæ* may be changed from *Leptolobium* to *Leptocyamus*.

† The *Thalesia* mentioned on this occasion in my paper, is a genus of *Martius*, which will probably be included in *Leptolobium* of Vogel.

plotropis on the one hand, and *Leptolobium*, and, perhaps, *Layia* on the other, than between *Ormosia* as a papilionaceous genus, and *Bowdichia* as a *Cassiea*. At any rate, the name of *Sebipireæ* must be abandoned on account of the identity of the genus *Sebipira* with *Bowdichia*.

Mora, as a genus of *Cassieæ*, is distinguished by the following character:

Calyx urceolato-campanulatus, breviter et late 5-dentatus, æstivatione imbricativa. *Corollæ* petala 5, æqualia. *Stamina* 10, exserta; quorum 5 petalis opposita, fertilia sunt, antheris bilocularibus medifixis longitudinaliter dehiscentibus; 5 petalis alterna, filiformia, antheris clavatis cassis. *Ovarium* breviter stipitatum, pluri-ovulatum. *Stylus* compressus, subrectus, stigmate tenui terminali. *Legumen* coriaceo-lignosum, oblongum, abortu (an constanter?) monospermum. *Semen* magnum, reniforme, cotyledonibus crassis sublignosis, radicula conica recta.

To the species I should propose the name of *Mora excelsa*; and to Mr. Schomburgk's general description of the appearance of the tree I would add the following notes taken from the dried specimens, No. 496, of his collection.

Folia alterna, abrupte pinnata, glabra. *Petiolus* communis infra foliola inferiora angulatus, superne teres, supra canaliculatus. *Foliola* 3-4-juga, opposita, petiolulata, oblongo-elliptica, coriacea, supra nitida, penninervia et reticulato-venosa, 5—6 poll. longa. Nec stipulæ nec stipellæ obviæ sunt. *Flores* sessiles, densissime spicati. *Spicæ* in paniculas terminales simplices dispositæ, rhachi pubescente. *Bracteæ* parvæ, squamæformes, citissime deciduæ. *Calyx* circiter 2 lin. longus, glaber, nitidus: *dentes* inter se ferè æquales, latè rotundati, margine breviter ciliati. *Petala* obovato-oblonga, calyce subduplo longiora, omnia æquilatera, et inter se æqualia, apice tenuissime ciliata, basi in unguem brevem angustata. *Stamina fertilia* lana longa intertexta citissimè decidua barbata, filamentis præsertim basi crassiusculis; *sterilia* glaberrima. *Stylus* glaber, stamina subæquans. *Semen* 3 poll. latum.

Under No. 148 of his collection Mr. Schomburgk has sent specimens from the Upper Essequibo, without any note, which only differ from the above by the flowers being smaller, the spikes shorter, the ovarium rather smaller in

G. Jarman sc

comparison to the style, and the nerves of the leaves more distinctly marked, differences which may probably be owing to the greater age and less vigour of growth of the tree from which they were taken.

EXPLANATION OF THE PLATES.

TAB. XVI.

Mora excelsa.

TAB. XVII.

Fig. 1. Flower. } magnified.
2. The same spread open. } magnified.
3. Pistillum. } magnified.
4. Longitudinal section of the ovarium. } magnified.
5. Mature legume.
6. Embryo, with one of the cotyledons removed to show the plumula.

XI. *On the Structure of* Cuscuta europæa. *By* Charles C. Babington, *Esq., M.A., F.L.S., F.G.S., &c.*

Read January 16th, 1838.

In Sir James Smith's English Flora (ii. 25.) it is observed that the flowers of *Cuscuta europæa* are "in all the British specimens as well as in Ehrhart's German ones destitute of scales in the throat of the tube (of the corolla), which Dr. Hooker confirms, in contradiction to the opinion of our learned friend Mr. Brown, who possibly examined specimens of *C. epithymum*, some of which often approach the *europæa* in size." Mr. Brown's words (Prodr. 491.) are, "squamæ in *C. europæa* et *monogyna* certè extant."

These conflicting statements led me to examine fresh specimens of the plant referred to, (gathered at Sompting in Sussex, in company with Mr. Borrer, who was fully satisfied of its being the true *C. europæa*,) and I have great pleasure in confirming the observation of Mr. Brown. The fact of these scales having been overlooked by Smith and Hooker is easily accounted for by their lying quite close to the corolla, their perfect transparency, and very minute size. They are, indeed, so difficult of detection as not to have been at first noticed by Mr. Borrer and myself, even when examining fresh specimens, and it is scarcely possible to discover them in flowers that have been dried.

Upon referring to the different authors who have described this plant, I find that the presence or absence of scales is frequently passed over without any notice:—That Persoon, Host and Besser (*Prim. Fl. Galliciæ Austr.*) say that they do not exist; Reichenbach describes and figures them as "palmato-subsexfidis;" Gaudin says, "in iconibus Sturmii, Schkuhrii et Eng. Bot. filamenta male depicta fuerunt. Squamæ enim utique, sed ægre conspicuæ adsunt;" and by Bluff and Fingerhuth, in their 2nd edition, they are said to be "erectis adpressis." This last description agrees with that of Mertens and Koch, whose words are, "aufrecht, angedrückt," erect and adpressed. Rœmer

and Schultes in their specific character say, "fauce nuda," but add the observation, "Squamulas ad stamina bifurcas vidit Raymond."

The strongly palmate form which is given to the scales in *Reich. Icon. Pl.* v. f. 690, and the words "squamula crenata" used by Spenner, caused me to examine numerous flowers before I could satisfy myself that their structure was such as I have given in f. 1., but I was unable to detect a single tooth upon any of the specimens. I cannot explain the cause of their error. Reichenbach figures each scale exactly under its corresponding stamen, and yet supposes them to be petals and to alternate with the stamens. He would appear to consider, what I believe to be one single scale, as in reality two. It may be as well to quote his words; they are, "Clarior enim redditur illa fabrica ubi intelligere placeat, stamina calyci adhærentia produci nec non usque inter ipsorum petalorum insertionem decurrere." (*Icon. Pl.* v. p. 62.). This view is manifestly incorrect, for the scales constitute a complete internal whorl, each of them being connected with its neighbour so as to form a short tube, the upper edge of which is always free and distinct from the corolla (calyx of Reich.), and the lower parts of the filaments of the stamens may be traced under the cuticle of the corolla, descending exactly behind the centre of each scale. It is perfectly clear, therefore, that the scales cannot represent petals, since the whorl of stamens is invariably found within that of petals, but in this plant the stamens are situated further from the axis of the flower than the so-called corolla.

I do not attempt to form any theory concerning these minute organs, but hope that some fortunate botanist will soon discover them in such a state of monstrous development as to show what is their real nature.

That the number of scales is equal to that of the segments of the corolla is proved by their structure in *C. epithymum,* in which plant they are not even divided into two lobes. There is not, indeed, the slightest trace of a division to be discovered with a very high power of the microscope. I ought to add, that Reichenbach does not continue the above theory in his *Flora excursoria*; but reverts to the old nomenclature.

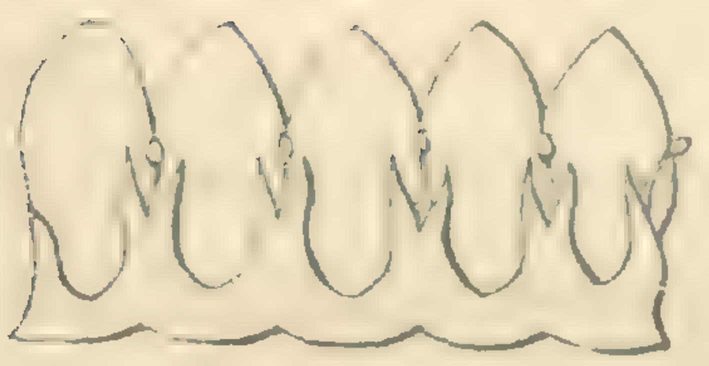
I shall not attempt a description of the scales in our two native species of *Cuscuta,* since my figures will convey a far better idea of their structure than can be given in words. Fig. 1. represents the corolla of *C. europæa* laid open,

so as to show the stamens and scales. Fig. 2. exhibits the same parts in *C. epithymum.* Fig. 3. is a traced copy from Reichenbach's representation (*Ic. Pl.* v. f. 690. B.) of *C. europæa.* It will be seen that this last differs materially from my fig. 1. May not his plant be a distinct species characterized by its constantly 4-cleft corolla and palmate sexfid scales? This genus is well deserving of attention from British botanists, for several other species are known in Germany, Sweden, and France, which most probably exist in these islands. I add corrected specific characters for our two recorded species.

C. europæa. LINN. (Sp. Pl. 180.) "florum glomerulis bracteatis" sessilibus, squamis bifidis erectis tubo corollæ per anthesin cylindrico, fructiferæ ventricoso, adpressis.

C. epithymum. SM. (Eng. Bot. sub p. 378.) "florum glomerulis bracteatis" sessilibus, squamis palmato-sectis conniventibus, tubo corollæ cylindrico limbo campanulato.

1.



2.

3.

St. John's College, Cambridge,
December 1, 1837.

Since this paper was written I have been informed that my friend Mr. J. E. Bowman has gathered *C. epilinum*, Weihe (Rchb. Ic. Pl. t. 500. f. 693,) at Croesmere in Shropshire. I have not seen specimens.

XII. *Note on the Identity of three described Species of* Acacia. *By* Charles Lush, *M.D. F.L.S.*

Read April 17th, 1838.

WHEN I was at Cairo in November last, Mr. Traill (Superintendant of the Gardens of Ibrahim Pasha) showed me some young plants of Roxburgh's *Mimosa Sirissa*, raised from seed which I had sent from Bombay. Both Mr. Traill and myself were convinced of the identity of this tree, called in the Marat'ha language *Sĭrŭs*, with the *Mimosa Lebbek* of Forskål's *Flora Ægyptiaco-Arabica*. Forskål does not assert that this tree is a native of Egypt,—" Kahiræ hortensis illa" is the *habitat* assigned by this author. There is, therefore, nothing to discourage the belief that this species was introduced into Egypt from India, where it is undoubtedly wild, in the drier mountain-jungles of the west.

I feel at the same time convinced that the *Mimosa speciosa* of Jacquin, Misc. vol. iii. 47., is also identical with the above species. The figure in that work precisely represents the Indian, and the Egyptian cultivated tree. I propose the following specific character, slightly altered from De Candolle's *Prodr. Syst. Nat.*, to include the three species with their synonyms.

Acacia Lebbek: inermis, glabriuscula; pinnis plerumque 4—6-jugis: foliolis 5—10-jugis ovalibus subdimidiatis utrinque obtusis, petiolis eglandulosis, capitulis pedunculatis aggregatis, floribus pedicellatis, leguminibus lato-linearibus planis membranaceis.

Mimosa Lebbek. Linn. Sp. Pl. p. 1503, cum synonymis.

Mimosa Lebbek. Forsk. Fl. Ægypt.-Ar. p. cxxiii. culta in planitie (Serisch Indis!)

Acacia Lebbek. Willd. Sp. Pl. iv. p. 1066. De Cand. Prodr. ii. p. 466.

Mimosa Sirissa. Roxb. Flor. Ind. vol. ii. p. 544.

Mimosa speciosa. Jacq. Misc. vol. iii. p. 47. Icon. vol. i. p. 19. t. 198.

XIII. *On the Number and Structure of the* Mammulæ *employed by Spiders in the Process of Spinning.* *By* John Blackwall, *Esq., F.L.S.*

Read June 5th, 1838.

WHEN the highly curious and important function performed by the spinning apparatus of spiders is duly considered, it will not appear surprising that the attention of zootomists has been repeatedly directed to the organization of parts exercising so remarkable a degree of influence upon the economy of the animals to which they belong, and that the powers of the microscope have contributed largely to promote the investigation of this interesting subject; but, though much has been accomplished by these researches, much yet remains to be effected; new facts must be elicited and prevailing errors corrected, before our knowledge of the matter under consideration can be regarded as exact.

Having carefully examined the external anatomy of the spinning mammulæ of various species of spiders, I have been led to form opinions relative to their number and structure differing essentially in several particulars from those generally received; and if, in promulgating the views which an accumulation of evidence too powerful to be resisted has compelled me to adopt, I find myself opposed to zoologists of the highest distinction and authority, it is, as I have formerly stated on similar occasions, with every sentiment of deference and respect, and with a perfect consciousness of the many and great disadvantages of the position which I occupy, that I venture to question the soundness of their doctrines.

All the spiders which have hitherto come under my observation have been provided with four, six, or eight spinning mammulæ, somewhat conical or cylindrical in figure, and composed of one or more joints each: they are usually closely grouped in pairs, which may be readily distinguished from each other by their relative positions. The pair situated nearest to the anus

I denominate the superior spinners; that furthest removed from the anus, the inferior spinners; and the mammulæ placed between these extremes, the intermediate spinners; distinguishing them, when there are two pairs, by prefixing the terms superior and inferior. Exceedingly fine moveable papillæ or spinning tubes, for the most part dilated at the base, occur at the extremity of the mammulæ, or are disposed along the inferior surface of their terminal joint; whence issues the viscous secretion of which the silken lines produced by spiders are formed. The minute apertures without projecting margins, described by Lyonnet, Leeuwenhoek, Treviranus, and other eminent anatomists and microscopic observers as likewise emitting lines*, I have failed to detect on the closest inspection, assisted by optical instruments possessing high magnifying powers; I am under the necessity, therefore, of withholding my assent from an opinion which, in consequence of the celebrity of its advocates, is very generally adopted. It is true that I can discern small pores with which the mammulæ are abundantly supplied; but as they are distributed over their entire surface, and occupy the intervals between their bases, from which no lines are ever seen to proceed; moreover, as I have never, under any circumstances, perceived the viscous matter of which the lines are composed issuing from these pores, but uniformly from the papillæ or spinning-tubes, I must regard the latter as solely instrumental in the emission of the silken filaments transmitted from the mammulæ; indeed, interspersed among the papillæ, as the pores constantly are, they would prove a source of the utmost inconvenience were they endowed with the property which seems to have been ascribed to them.

Attempts have been frequently made to ascertain the number of papillæ connected with the spinning mammulæ of spiders; but in every instance with which I am acquainted they appear to be estimated much too highly; in point of fact, they vary greatly in number in different species, and also differ considerably in size, not only in individuals of the same species, but often even on the same mammulæ.

Among British spiders, the larger species of *Epeiræ* have the mammulæ most amply provided with papillæ; it is probable, however, that the total number does not greatly exceed a thousand even in adult females of *Epeira*

* Cyclopædia of Anatomy and Physiology, p. 209.

quadrata, whose weight is about twenty grains, and in many other species it is much smaller. Each of the six mammulæ, in every living *Epeira* whose spinning apparatus I have attentively inspected, has presented one or more papillæ decidedly larger than the rest, which uniformly occupy the same relative situations in individuals identical in species; but I have not yet been able to satisfy myself what especial purposes they subserve.

Wishing to determine by experiment the strength of a line by which a female *Epeira diadema*, weighing ten grains, had suspended itself from a twig, I attached to its extremity a small square piece of muslin with the corners nearly drawn together, so as to form a minute sack, into which I carefully introduced sixty-one grains in succession, being rather more than six times the weight of the spider, before it broke; but on the addition of half a grain more it gave way.

In several species belonging to the genus *Tegenaria* of Walckenaer, in *Tegenaria domestica* and *Tegenaria civilis*, for example, the total number of papillæ does not amount to four hundred; in *Textrix agilis*, Blackw., *Lycosa saccata*, and *Clubiona corticalis*, it is below three hundred; in *Walckenaera** *acuminata*, Blackw., and *Segestria senoculata*, it scarcely exceeds one hundred; and in many of the smaller spiders it is still further reduced.

A difference in the number and size of the papillæ connected with the several pairs of mammulæ in the same species, and with similar pairs in different species, is also very apparent. In the spiders constituting the genera *Epeira*, *Tetragnatha*, *Linyphia*, *Theridion*, *Segestria*, and many others, they are generally much more numerous and minute on the inferior spinners than on the superior and intermediate ones; the last are the most sparingly supplied with them, and in the case of *Segestria senoculata* each has only three large papillæ at its extremity. An arrangement nearly the reverse of this takes place in some of the *Drassi*, and may be advantageously seen in *Drassus ater*. This species has the intermediate spinners abundantly furnished with papillæ, those on the inferior spinners being very few in number and chiefly of large dimensions, emitting the viscous secretion copiously. For the purpose of determining how many papillæ are connected with the short terminal joint of each

* This generic name, which, through my own inadvertency, has hitherto been printed *Walckenaeria*, is now corrected.

inferior spinner of *Drassus ater*, which can be wholly retracted within the middle joint at the will of the spider, I subjected numerous individuals to a strict scrutiny, when I was surprised to discover that the number varied with the age of the animals. In specimens which had attained nearly a third of their growth they usually amounted to five or six; in others, which were about two-thirds grown, to six or seven; and in adults, which had acquired their full complement, they were uniformly eight; two of them, situated on the inferior surface of the spinner, at a greater distance from its extremity than the rest, being minute and almost contiguous. It is a fact deserving of notice, that the papillæ are not always developed simultaneously on these spinners, six, seven, or eight being sometimes observed on one, when five, six, or seven only are to be seen on the other; and this remark is applicable, not to the inferior spinners alone, but to the intermediate ones also, which, in mature individuals, are further modified by having the extremities of the terminal joints directed forwards at right angles to their bases. I have, in like manner, ascertained that the papillæ connected with the inferior spinners of *Drassus cupreus*, Blackw., and the superior spinners of *Segestria senoculata*, follow the same law of development; but whether it does or does not hold good with the papillæ on the spinning mammulæ of spiders in general, I am not at present prepared to decide; yet, could I rely on analogy, and on the results of observations, too limited and imperfect to command implicit confidence, I should be disposed to answer affirmatively. The inquiry, however, to which I am solicitous to direct the attention of arachnologists, is one of considerable interest.

In addition to the papillæ on the terminal joint of the superior spinners of *Walckenaera acuminata*, a large one, much dilated at its base, occurs near the extremity of their middle joint, on the inner surface.

The superior and inferior spinners of many spiders are triarticulate; and when the terminal joint of the former is greatly elongated, thickly clothed with hairs, and tapers to a point; the papillæ, in the form of hair-like tubes, dilated at the base, are commonly distributed along its inferior surface, as in the case of *Tegenaria domestica*, *Tegenaria civilis*, *Agelena labyrinthica*, *Textrix agilis*, *Drassus saxatilis*, Blackw., and some other British species. This deviation from the prevailing structure has induced Lyonnet, Savigny, Trevi-

ranus, Audouin, and other skilful zootomists, who have failed to detect the papillæ, to regard the superior mammulæ, thus modified, as anal palpi, and to deny that they perform the office of spinners; an opinion in which they are followed by the most eminent arachnologists of the present day. A rigorous examination of these parts during the exercise of their function by living specimens of *Agelena labyrinthica*, led me six or seven years ago to a correct knowledge of their external organization: a discovery which was published in 1833*, and republished in 1834†.

The intermediate spinners, when limited to a single pair, are usually biarticulate, and sometimes, with the inferior spinners, have their basal joints connected or inclosed in a common envelope.

Spiders are stated to have two, four, or six spinners according to the office which the superior mammulæ are supposed to perform. Some observers, who believe them in every instance to be anal palpi or feelers, even where the terminal joint is short and the papillæ are situated at its extremity, assert that all spiders have two or four spinners; others, who regard the superior mammulæ as feelers only when the terminal joint is considerably elongated and the papillæ are arranged along its inferior surface, estimate the number of spinners with which spiders are provided at two, four, or six; while those observers, who admit the fact that silken lines are emitted from all the mammulæ, conclude that every spider has four or six spinners. I have already expressed my own conviction that spiders have four, six, or eight spinners; a conviction induced by the recent discovery of an additional pair of mammulæ in certain species.

The newly-discovered mammulæ were first noticed by me about the year 1828, on inspecting the spinning apparatus of *Clubiona atrox*; but I was quite ignorant of their true character at that time, and only obtained a satisfactory knowledge of it last autumn by a patient investigation of their external structure in living specimens. I may remark, that they are shorter, and further removed from the anus than the other mammulæ, being situated at the base of the inferior intermediate pair, by which they are almost concealed when in

* Report of the Third Meeting of the British Association for the Advancement of Science, held at Cambridge in 1833, p. 445.

† Researches in Zoology, p. 298, *et seq.*

a state of repose. Their figure is somewhat conical, but compressed and truncate, so that the base and apex are elliptical with long transverse axes. Consisting of a single joint only, each mammula is connected with the other throughout its entire length, the extremity alone being densely covered with exceedingly minute papillæ, which emit the viscous matter that is formed into the pale blue bands, constituting the most important part of the snare of this spider, by means of the combing or rather curling instrument, which I propose to name *calamistrum* *. Having detected the connexion subsisting between the new spinners and the *calamistrum*, I confidently anticipated that spiders provided with the latter would likewise possess the former; and such I found to be the case on examining *Drassus viridissimus*, Walck., *Drassus parvulus*, Blackw., and *Drassus exiguus*, Blackw. MS., which, together with *Clubiona atrox*, are the only species at present known to have the metatarsal joint of the posterior legs furnished with the curling apparatus †.

Thus it appears that spiders provided with *calamistra* have eight spinners; and as it has been demonstrated that the superior mammulæ, though modified in form, always perform the office of spinners, it follows that spiders with six mammulæ, comprising much the greater number of genera, and those with four mammulæ, constituting a few genera only, *Mygale* and *Oletera*, for example, have precisely as many spinners as mammulæ.

A small, conical, hairy process resembling a mammula, on which, however, I cannot discern any papillæ, occurs at the base of the inferior spinners in various species belonging to the genera *Epeira*, *Tetragnatha*, *Linyphia*, *Walckenaera*, *Manduculus*, &c.: what influence it exercises upon the economy of those spiders in which it is found remains to be discovered.

* A description and figures of the *calamistrum* are published in the Transactions of the Linnean Society, vol. xvi. p. 473—4. tab. xxxi. fig. 2, 3. In the same volume, p. 476, an account is given of a strong, moveable spine inserted near the termination of the tarsus of each posterior leg, on the under side, in spiders belonging to the genus *Epeira*, which I propose to denominate *sustentaculum*.

† Researches in Zoology, p. 275, 338, 341.

XIV. *Observations on some Genera of Plants connected with the Flora of Guiana.* *By* George Bentham, *Esq., F.L.S.*

Read June 19th, 1838.

1. Symplocos, Ciponima, Stemmatosiphon, Alstonia and Hopea.

In Pohl's *Plantarum Brasiliæ Icones*, vol. ii. pl. 157, 158, and 159, three plants are figured under the name of *Stemmatosiphon*, and referred to *Meliaceæ*, on account of some similarity in the disposition of the stamina and the form of the corolla, if considered as polypetalous. Adrien de Jussieu, however, in a note added to his excellent memoir on *Meliaceæ* (*Mém. du Mus.* vol. xix. p. 152.) adverted to the simple leaves, indefinite stamina, &c., as incompatible with that family; but, misled by several errors in the details of structure figured by Pohl, was unable to point out satisfactorily the group to which it should be removed*. On the occasion of determining the plants collected in Guiana by Mr. Schomburgk, I was struck with the apparent affinity of one of them to the specimens of Pohl's *Stemmatosiphons*, which I had obtained at Vienna, and was led into an examination of that genus, which proved to be identical with the Linnean *Symplocos*, as first constituted, although differing in many points from many of the other species which have since been associated with it.

The genus *Symplocos* was originally founded by Jacquin, and adopted by Linnæus, for the *S. martinicensis*, which was thus characterized by Linnæus in his *Genera Plantarum*: "*Perianthium* monophyllum, semiquinquefidum, parvum, laciniis subrotundis erectis. *Petala* quinque, oblonga, obtusa, erecta, superne patentissima. *Filamenta* plurima, subulata, plana, petalis breviora,

* The remarkable circumstance in particular of a trifid stigmate, with a quadrilocular ovarium, figured in each of the three plates, does not exist in any flower that I have dissected of either of the species.

serie quadruplici corollæ tubo accreta, inferioribus brevioribus. *Antheræ* subrotundæ. *Germen* subrotundum. *Stylus* filiformis, longitudine staminum. *Stigma* capitatum subtrifidum."

The above character will be found in every respect, as far as it goes, admirably adapted to Pohl's *Stemmatosiphons*, as well as to the original *Symplocos*, and to Aublet's *Ciponima*; for although the words *Petala quinque* rather indicate a polypetalous corolla, yet their adherence at the base is plainly indicated by the subsequent expression, *Filamenta . . . . tubo corollæ accreta*.

L'Héritier in the first volume of the Linnean Transactions (p. 174.) first proposed the joining the genera *Hopea* (*Linn. Mant. p.* 14.), *Alstonia* (*Linn. Fil. Suppl. p.* 39.), and *Ciponima* (*Aubl. Plant. Guian.* i. p. 567. t. 226.) to *Symplocos*, of which it became consequently necessary to modify the character in many points, of which the most important are, *Calyx* superus quinquepartitus. *Corolla* . . . . campanulata . . . . petalis s. laciniis 5—10 . . . . basi in tubum longitudine calycis coalitis . . . . *Filamenta* . . . . submonadelpha s. basi inæqualiter connexa . . . . in plures ordines imbricata . . . . *Germen* inferum . . . . *Stigma* . . . . subquinquelobum. To these were also added the carpological characters, Linnæus himself not having seen the fruit of his *Symplocos*.

In regard to the relative situation of the calyx and ovarium (or *germen*, as it was formerly termed,) there is here an inconvenience in expression still adhered to generally by British botanists, although long since adverted to and corrected by continental authors, who speak of the calyx as *free* or *adnate*, instead of *inferior* and *superior*. In *Symplocos* and in all the genera associated with it the tube of the calyx is generally more or less free from the ovary at the time of flowering, but with the development of the fruit it adheres to it more and more, till, at the maturity, the tube of the calyx becomes entirely confounded with the fleshy pericarp, and the segments alone remain free, crowning the fruit at the top,—a circumstance difficult to describe with the old nomenclature, unless on the supposition, that during the maturation the calyx moves from its original point of insertion.

As to the corolla and stamina, L'Héritier's character, intended to apply both to *Symplocos*, Linn., and *Hopea*, Linn., is not so correct as Linnæus's for the former genus, nor does it either apply with accuracy to the latter one, which has scarcely any tube to the corolla, and in which the stamina cannot be said to

be imbricate. The stigma may as well be described as *subquinquelobum* as *subtrifidum*, for the carpellary number varies from three to five in most species. L'Héritier's character of the fruit, as far as it goes, applies to all his species.

Persoon in his Synopsis (vol. ii. p. 74.) adopts L'Héritier's views in uniting *Alstonia* and *Ciponima* with *Symplocos*, but again separates *Hopea*; and Gærtner (*Carpologia*, iii. p. 139. *et seq.* t. 209. *f.* 1, 2, 3.) not only follows Persoon in considering the latter genus as well characterized by a pentapetalous corolla, pentadelphous stamina, and a trilocular drupe, but also re-establishes *Ciponima*, distinguishing it chiefly by the stamina being in a double, not in a quadruple row, as in *Symplocos*, the anthers bilocular, not quadrilocular, the drupe quadrilocular, and the embryo erect, not inverted as in *Hopea*.

Of all these characters, those derived from the corolla and stamina alone appear to be of any importance. The quadrilocular anthers of *Symplocos* are a mistake; the position of the embryo, it is now well known, varies in *Symplocos* in different seeds in the same drupe, and the number of cells of the ovary is very variable, at least in the true species of *Symplocos*.

On these grounds, probably, Bonpland (*Pl. Æquin.* i. p. 180.), followed by Kunth, (*Nov. Gen. et Sp. Pl. Amer.* iii. p. 256.) returns to L'Héritier's opinion, that the four genera form but one. In the first of these works Bonpland adds to the six species then known eight new ones, and commences his monographic sketch with a new character, in which the corolla is described as "disco epigyno imposita, polypetala vel monopetala; polypetala, petalis circiter 10, duplici serie dispositis, exterioribus majoribus, basi in formam tubi arcte cohærentibus, monopetala, tubo brevi, laciniis 10 ut in polypetala dispositis." This is evidently taken from *S. Alstonia* (*Pl. Æquin.* t. 51.) and *S. coccinea* (t. 52.); it is also applicable, with a slight modification as to the number of petals of the inner series, to *S. cernua* (t. 53.), but is completely at variance as well with *S. serrulata* and *S. rufescens*, figured in the same work (t. 54 & 55.), as with the original *S. martinicensis*, Aublet's *Ciponima*, and Linnæus's *Hopea*.

The subsequent additions to the genus consist chiefly of Asiatic species, of which *S. sinica* was figured and described in detail by Ker in the Botanical Register (vol. ix. t. 710.), the *S. Loha*, *Sumuntia*, *theæfolia*, and *cratægoides* were established by D. Don, *Prodr. Fl. Nepalensis*, p. 144., the *S. racemosa*, *spicata*, and *ferruginea*, by Roxburgh *Fl. Ind. Or.* vol. ii. p. 539. None of these

authors, however, appear to have much studied the generic character, which they have taken more or less from some of the above-mentioned botanists, Don observing only "Genus fortè iterum dividendum."

Since the above I am not aware of any modification in the character or species of *Symplocos*, until the publication of the last volume of G. Don's General System of Gardening and Botany, where all the hitherto published species are collected, those merely named in Wallich's Catalogue are described, the genus is retained as established by L'Héritier and Bonpland, but raised to the rank of a natural order, and divided into three sections: *Alstonia*, containing all the American species said to be distinguished by an 8—10-parted corolla, the segments in a double row, stamens in 3 or 4 series, and a half inferior drupe; *Lodhra*, consisting of 17 Asiatic species, to which are attributed a 5-parted corolla, stamens inserted without order, and an inferior drupe; and *Palura*, described as having the same corolla, with stamens in a triple series, and an inferior ovary. Under this section are enumerated two remaining Asiatic species.

These characters, however, by no means correspond with the specific characters given in the same work to several of the species, and will be found on examination still more at variance in many instances with the plants themselves. Thus in the section *Alstonia*, three species at least have a 5-parted corolla, the segments in many of them are not in a double row; the stamens of *S. tinctoria* are arranged as in the Asiatic species, and the calyx is as adherent to the drupe in *Alstonia* as in *Lodhra* and *Palura*. In the latter respect I cannot see any difference between the *S. sinica* and the several plants referred to *Lodhra*; and if there is any greater regularity in the arrangement of the stamina in *S. cratægoides* than in *Lodhra*, it is that they are more decidedly pentadelphous and not biseriate.

Amidst all these conflicting opinions, after a careful examination of a considerable number of both American and Asiatic species, it appears to me that there do exist three distinct groups, which it might be adviseable to consider as so many genera. In the true *Symplocos* of Linnæus the stamina are erect, the filaments are flat, monadelphous at the base, free in the upper part, where they are distinctly imbricated in three or four rows, and suddenly attenuated below the anther; the corolla is erect and adherent to the staminal tube,

often above the middle, and then suddenly expanded; the segments are always in a single row, (though imbricate in æstivation,) nearly equal in size, and 5 in number in the species I have seen, 6, or perhaps more, in some described by Bonpland, and the ovary 3- 4- or 5-celled. Of this group I have examined *S. martinicensis*, Linn., *S. Ciponima*, *S. Arechea*, L'Hér., *Stemmatosiphon platyphyllum*, *nitens*, and *uniflorum*, Pohl., *Symplocos pubescens*, Klotsch, and two new species described below; and, judging from Bonpland's figures, I should likewise refer to it his *Symplocos serrulata* and *rufescens*.

As a second genus, or at any rate as a distinct section of *Symplocos*, I should propose to restore Linnæus's *Alstonia*, characterized by a more campanulate corolla, with an inner row of small corolline segments, which may perhaps be considered as an outer row of sterile stamina. I have only seen one species, the *Alstonia theæformis*, Linn., and of that I could only dissect one imperfect flower, in which the inner row of petals was very irregular, and certainly took the place of some of the external stamina. I should associate with it Bonpland's *Symplocos cernua* and *coccinea*, judging from the figures, and perhaps also *Symplocos tomentosa*, Bonpl., and *S. octopetala*, Swartz. But it would require a re-examination of all these species to determine the importance of the inner row of petals as characterizing a section or a genus.

In the third very distinct genus, *Hopea*, Linn. (not Roxb.), the aspect of the flower is very different; the corolla is almost rotate, constantly uniseriate at the base, though the divisions be imbricate, and 5- or 6-cleft; the stamina are also spreading, their filaments slender, but slightly connected at the base, often somewhat pentadelphous, and usually longer than the corolla. I have also never found more than three cells to the ovary, (in *H. sinica* and *cratægoides* there are but two,) and the species appear much more apt to dry yellow than in the true *Symplocos*. I would refer to *Hopea*, so characterized, *H. tinctoria*, Linn., and the greater number, if not all the Asiatic species. Amongst these the *S. sinica*, Bot. Reg., and *S. cratægoides*, Hamilt., should form a distinct section, as proposed by Don, but characterized by the bilocular ovarium and comparatively slender stigmata. There appears also to be a considerable diversity in the fruit, which is pear- or bottle-shaped, and very small in *S. spicata*, Roxb., *S. polycarpa*, Wall., and *S. laurina*, Wall., small, oblong, and

shining in *S. adenophylla*, Wall., large, oblong, and rough in *S. cerasifolia*, Wall., large, globular, and rough in *S. mollis*, Wall., which appears very near to *S. ferruginea*, Roxb. I have not seen the fruit of the other species, but I have no doubt that, when better known, the carpological characters will afford good sectional distinctions.

Of the remaining published species, the *Symplocos nuda*, *Limoncillo*, and *mucronata*, Humb. et Bonpl. Pl. Æquin., and *S. Schiedeana*, Schlechtendal, (Linnæa, viii. 527.) must remain doubtful, as their corolla has not been seen. *S. pentagyna* of Sprengel must be omitted altogether, having certainly no connexion with *Symplocos*. It would be impossible, indeed, without seeing his specimen, to say what it might be, but at a guess his character reads most like that of a *Vismia*.

The above genera, with *Styrax*, *Strigilia*, and *Halesia*, form a small order, or perhaps a tribe of *Ebenaceæ*, established by Richard under the name of *Styraceæ*, and more or less adopted by most subsequent botanists, but with very different ideas as to its extent. D. Don, followed by some others, established three distinct orders, *Symplocineæ*, *Styraceæ*, and *Halesiaceæ*, the distinctions between which are thus stated by G. Don: *Styracineæ* are "very nearly allied to *Halesiaceæ*, but differ by the decidedly superior ovarium and the more deeply-cleft corolla, and from *Symplocineæ* in the superior ovarium and entire or slightly-lobed calyx, and in the stamens being fewer and monadelphous." (Gen. Syst. of Gard. and Bot. iv. p. 4.) *Halesiaceæ* come "nearest to *Symplocineæ*, from which they differ in the inferior ovarium, in the fruit being a hard dry winged nut, and in the corolla being more decidedly monopetalous." (Ibid. p. 6.)

It is difficult, however, not to agree with Richard in neglecting in this instance, notwithstanding its great importance in other cases, the degree of adherence of the calyx to the fruit: for it will be found that at the time of flowering the calyx adheres to the ovary at its base even in *Styrax*, and is rarely completely adherent even in *Halesia*; whilst in the different species of *Symplocos* and *Hopea* almost every intermediate degree may be observed. The chief difference lies in this: that, as the fruit swells, it is the adherent part of the ovary that is developed in *Symplocos*, *Hopea*, and *Halesia*, and the free portion only in *Styrax*; and it is, I believe, generally recognized, that a

diversity of form in the fruit, arising only during its growth from the state of ovary, is rather a generic than an ordinal distinction.

Besides this difference in the fruit, *Styrax* and *Strigilia* have a definite number of stamens, but their insertion and connexion at the base into a short tube is the same as in *Symplocos* and *Halesia*.

The character of *Halesiaceæ* derived from the winged fruit loses what little importance might have been given to it, when it is considered that it is not the "nut" itself that is winged, but merely the calyx inclosing it, which in its development becomes fleshy in *Symplocos*, and herbaceous and winged in *Halesia*,—a good generic, but no ordinal distinction.

Lindley, in the second edition of his Natural System, besides the above genera, enumerates under *Styraceæ* the five following: *Diclidanthera*, Mart., *Paralea*, Aubl., *Turaria*, Molin., *Morelosia*, Llave, and *Decadia*, Lour. Of these, *Diclidanthera* is the only one which is satisfactorily described, and Martius is evidently right in ascribing it to *Ebenaceæ*; but the separate insertion of the anthers in the throat of the corolla remove it from the tribe or order of *Styraceæ*: *Paralea* and *Decadia* appear also, as far as can be judged from the very imperfect descriptions, to be nearer the true *Ebenaceæ* than to *Styraceæ*: *Morelosia* must be very different, and may very likely belong to *Convolvulaceæ*, where Don places it.

With respect to the affinities of *Styraceæ* as an order, their alliance with *Ebenaceæ* amongst *Monopetalæ*, and with *Humiriaceæ* in the first instance, and in the next place with *Meliaceæ*, and perhaps with *Aurantiaceæ* and *Olacineæ* amongst *Polypetalæ*, has been already pointed out, and have only been confirmed, as far as my observations have led me; but my object not being to give a monograph of the order, I now merely add the characters which I should propose for such of the true *Symploci* as I am acquainted with.

Symplocos. *Linn.*

Calyx basi ovario adhærens, limbo 5-fido, laciniis latis, æstivatione imbricatis. *Corolla* gamo-petala, profunde 5—7-fida, basi erecta, laciniis apice patentissimis, uniserialibus, æstivatione imbricatis. *Stamina* numerosa, 3—4-serialia, erecta, basi in tubum corollæ adnatum coalita; filamenta superne libera, dilatata, imbricata, apice abrupte acuminata. *Antheræ* ovatæ,

erectæ, basifixæ, biloculares. *Ovarium* basi adnatum, apice liberum, 3—5-loculare, loculis sub-4-ovulatis, ovulis pendulis. *Stylus* simplex. *Stigma* capitatum, 3—5-fidum. *Drupa* calyce adnato carnoso inclusa, putamine lignoso, 1—5-locularis. *Semina* in quoque loculo sæpissime solitaria, oblonga, lateraliter affixa. *Embryo* in albumine copioso lineare, erectus, vel inversus.

Arbores mediocres, vel frutices elati, in America calidiore provenientes. *Rami* alterni, patentes. *Folia* alterna, simplicia, petiolata, integra, integerrima, vel serrata, serraturis sæpe glanduliferis, coriacea, supra glaberrima, nitida, subtus glabra, vel pubescentia. *Racemi* breves, axillares, pluri- vel rarius subuni-flori. *Rhachis* et *pedunculus* sæpissime pubescentes. *Flores* in pedunculo sessiles, vel breviter pedicellati, bracteis 2—5 laciniis calycinis similibus suffulti. *Calyces* ciliati. *Corollæ* albæ, vel lutescentes. *Ovarium* apice et *stylus* basi hirta. *Flores* in plerisque speciebus odoratissimi.

1. *S. nitens*, foliis obovato-oblongis obtusissimis integerrimis subundulatis ramisque glaberrimis, pedunculis multifloris petiolum brevem vix superantibus.

Stemmatosiphon nitens. Pohl! Pl. Bras. Ic. ii. p. 88. t. 158.

Hab. in Brasiliæ provincia Minas Geraes et Goyaz. *Pohl!*

2. *S. martinicensis* (Linn. Sp. p. 747.), foliis oblongo-ellipticis obtuse acuminatis late undulato-crenatis basi angustatis utrinque ramisque glaberrimis, pedunculis plurifloris petiolum subæquantibus.

Hab. in Antillis. *Anderson!* in Martinica. *Jacquin.*

3. *S. laxiflora*, foliis oblongis acuminatis basi angustatis margine obtuse serrulatis, junioribus subtus ad venas ramulisque hirtellis, pedunculis petiolo longioribus apice laxe 3—5-floris. Tab. XVIII.

Hab. in Brasiliæ montibus Serra Orgaõ dictis. *Gardner!* Pl. exs. n. 343.

4. *S. parviflora*, foliis ovatis ellipticisve obtusiusculis basi rotundatis margine serrulatis, junioribus subtus ramulisque hirtellis, pedunculis 1—3-floris petiolum brevem vix æquantibus.

Hab. in provincia Rio Grande. *Tweedie!*

5. *S. Arechea* (L'Hér. Trans. Soc. Linn. Lond. i. p. 176.), foliis oblongo-ellipticis obtuse acuminatis serrulatis, junioribus subtus ramulisque puberulis, pedunculis petiolo pluries brevioribus dense 3—5-floris.
Hab. in Peruvia. *Mathews!* Pl. exs. n. 2016.

6. *S. serrulata* (Humb. et Bonpl. Pl. Æquin. i. 190. t. 54.). Species mihi ignota *S. Archeæ* similis videtur, sed foliis subsessilibus facile distinguenda.
Hab. prope Popayan. *Humboldt* et *Bonpland.*

7. *S. rufescens* (Humb. et Bonpl. l. c. p. 192. t. 55.). Nec hanc speciem vidi. Ex icone distinctissima videtur.
Hab. in Monte Quindiu. *Humboldt* et *Bonpland.*

8. *S. pubescens* (Klotsch in Herb. Lindl. MSS.), foliis ovato-ellipticis oblongisve breviter acuminatis serratis basi angustatis supra reticulatis subtus ramulisque pubescenti-villosis, pedunculis plurifloris petiolum subæquantibus, calycibus glabriusculis longe ciliatis corolla subquintuplo brevioribus.
Hab. in Brasilia. *Sellow!*

9. *S. platyphylla*, foliis ovato-ellipticis breviter acuminatis obtusisve serratis basi rotundatis supra bullulatis reticulatis subtus ramulisque pubescenti-villosis, pedunculis multifloris petiolum æquantibus, calycibus villosissimis corolla vix quadruplo brevioribus.
Stemmatosiphon platyphyllum. Pohl! Pl. Bras. Ic. ii. p. 87. t. 157.
Hab. in Brasiliæ provincia Minas Geraes. *Pohl!*

10. *S. Ciponima* (L'Hér. Trans. Soc. Linn. Lond. i. 175.), foliis ovatis oblongisve breviter acuminatis integerrimis serratisve supra lævissimis subtus sparse hirtellis, ramulis pubescentibus, pedunculis brevissimis multifloris, calycibus villosis.
Hab. in Guiana Gallica. *Aublet*; in Guiana Anglica ad flumen Essequebo. *Schomburgk!* Pl. exs. n. 383. (foliis plerisque ovatis basi subcordatis), et n. 276. (foliis plerisque oblongis basi rotundatis).

11. *S. uniflora*, foliis ovatis acuminatis serratis subtus ramulisque ciliato-hirtis, pedunculis unifloris petiolo longioribus.

Stemmatosiphon uniflorum. Pohl. Pl. Bras. Ic. ii. p. 89. t. 159.

Hab. in Brasiliæ provincia Minas Geraes. *Pohl.!*

2. SEGUIERIA.

The circumstance of a polyandrous genus amongst the true *Monochlamydeæ* is of so rare occurrence, that the first impression conveyed by an unknown plant of that description is that of a defective polypetalous one; and accordingly, although some species or other of *Seguieria* occurs in most extensive South American collections, I have usually found it amongst *Swartzieæ* or with *Securidaca,* to both of which the genus bears some external resemblance. For this reason, probably, not only no new species has yet been described since Jacquin and Linnæus published the original *S. americana,* but even of that plant no description has appeared but what has been taken from one of those two authors. The affinities of the genus were entirely unknown, until Brown, who had examined three Brazilian species, associated it (App. to Tuckey, p. 36.) with *Petiveria* as a tribe of *Phytolaceæ.*

The peculiarities of this tribe are there alluded to in the following words: "The lateral stigma, the spiral cotyledons, and want of albumen in *Petiveria,* remove it to some distance from the other genera of *Phytolaceæ,* and at the same time connect it with *Seguieria,* with which also it agrees in the alliaceous odour of the whole plant." The lateral stigma and solitary carpel is very remarkable in all species of *Seguieria*; in the seeds I examined, which were unripe, I found a considerable quantity of mucilage resembling albumen, and a small, somewhat curved embryo, with cotyledons by no means spiral, giving me the idea that they were very similar to the seeds of several true *Phytolaceæ*; it is only when they arrive at maturity, in which state Mr. Brown examined them, that their true structure may be seen. Although my specimens are insufficient in this respect, yet the genus is so little known, and so remarkable in other points, that I have added to the following synopsis of the species known to me, a figure of one, in which the fruit, though immature, has attained its full size.

SEGUIERIA. *Linn.*

Perigonium calycinum, quinquepartitum, laciniis parum inæqualibus, æstivatione imbricativa, 2 exterioribus, 3 interioribus, per anthesin reflexis.

Stamina numerosa, basi perigonii inserta. *Filamenta* filiformia. *Antheræ* erectæ, lineari-sagittatæ, biloculares, loculis rima longitudinali dehiscentibus. *Ovarium* sessile, liberum, uniloculare, ovulo unico erecto. *Stylus* erectus, complanatus, hinc lateraliter stigmatiferus, inde membranaceo-alatus. *Fructus* indehiscens, coriaceus, apice ala longa acinaciformi, uno latere incrassata auctus, et in utraque facie alis 3—4 parvis irregulariter striatus. *Semen* unicum, subrotundum. *Embryo* (*junior*) parvus, linearis, parum incurvus, lateralis, cotyledonibus rectiusculis. *Frutices* scandentes? Austro-Americani, glabri, vel ramulis leviter pubescentibus. *Folia* alterna, integerrima, punctis minutis creberrimis pellucidis conspersa. *Stipulæ* induratæ, persistentes, sæpissime spinescentes. *Paniculæ* axillares vel terminales, irregulariter ramosæ, multifloræ, subaphyllæ. *Flores* flavescenti-virides.

1. *S. parvifolia*, stipulis minimis tuberculiformibus vix spinescentibus, foliis ovali-oblongis herbaceis basi in petiolum angustatis.

Hab. ad Rio Jaquhy. *Tweedie!*

Folia vix sesquipollicaria, petiolo 3—4-lineari. *Panicula* terminalis, parum ramosa.

2. *S. coriacea*, stipulis longis validis rectis spinescentibus, foliis subsessilibus oblongis obtusissimis coriaceis.

Hab. in montibus Acurua provinciæ Bahiensis. *Blanchet!* Pl. exs. n. 2908.

Folia 2—3-pollicaria. *Paniculæ* in exemplari meo axillares paucifloræ.

3. *S. longifolia*, stipulis brevissimis recurvis spinescentibus, foliis subsessilibus lanceolato-ellipticis acuminatis reticulatis coriaceis.

Hab. ad Mathea Barboso in Brasilia. *Pohl!*

Folia 3½—5-pollicaria. *Paniculæ* axillares vel terminales.

4. *S. floribunda*, stipulis minimis tuberculæformibus vix spinescentibus, foliis breviter petiolatis ovatis acuminatis coriaceis, paniculæ rhachide pubescente. TAB. XIX.

Hab. in Brasiliæ montibus Orgaõ. *Gardner!* Pl. exs. n. 722.

Folia 3—4-pollicaria. *Panicula* amplissima.

5. *S. macrophylla*, stipulis spinescentibus recurvis, foliis breviter petiolatis amplis ovato-ellipticis acuminatis, paniculæ rhachide glabra.

Hab. in Guiana Anglica ad flumen Essequebo. *Schomburgk!* Pl. exs. n. 348.

Frutex scandens. *Folia* 5—7-pollicaria. *Paniculæ* terminales amplæ, axillares divaricatæ. *Flores* majores quam in præcedentibus, luteo-virides.

6. *S. foliosa*, stipulis spinescentibus recurvis, foliis petiolatis ovatis obtuse acuminatis, paniculis terminalibus paucifloris basi foliatis.

Hab. in Guiana Anglica. *Schomburgk!* Pl. exs. n. 661.

Folia 1½—2-pollicaria. *Inflorescentia* ab omnibus diversa.

7. *S. americana* (Linn. Sp. p. 747.), ab omnibus differre videtur, foliis apice emarginatis.

3. Anthodiscus.

The genus *Anthodiscus* was established by G. F. W. Meyer in his *Primitiæ Floræ Essequeboensis*, *p.* 193, for a Guiana tree, which he places in *Icosandria* on account of the insertion of the stamina: "annulo calycino germen cingente." He compares it in that class with some *Myrtaceæ*, with *Acacia*, and with *Phytolacca*; but in a natural arrangement it differs widely from the first in its free ovarium, from *Acacia* in its polycarpous structure, from *Phytolacca* by the dichlamydeous perigonium. Since Meyer, it appears to have been generally overlooked, not being mentioned by De Candolle either amongst his *Thalamifloræ* or amongst the polypetalous *Calycifloræ*, and being entirely omitted by Bartling, Lindley and others in their enumerations of genera. Sprengel took it up, however, in his *Systema*, and Meisner introduces it into his Generic Tables as a spurious Rosaceous plant, allied also in its (imperfectly known) fruit to *Phytolacca*.

Amongst Schomburgk's specimens is one which answers so well in external characters to Meyer's description of his *Anthodiscus trifoliatus*, that I have little doubt of its being the same species, more especially, as I find a similar specimen in Dr. Lindley's herbarium, proceeding, I believe, from Mr. Parker's Demerara collection. These specimens differ, however, from Meyer's character in some points of structure, perhaps not much attended to at that time, but which are now of considerable importance in a natural arrangement. The disk from which the stamens arise is hypogynous, not perigynous,—a circumstance that removes the plant at once from *Rosaceæ*; and the general

habit of the plant, notwithstanding its occasionally alternate leaves, and the structure of the stamens and ovarium, show a close affinity to *Rhizoboleæ*. It may, in short, be described, as far as can be ascertained without a knowledge of the fruit, as a polygynous *Caryocar* with cohering petals and leaves often alternate.

It is true that Meyer does not mention the coherence of the petals; but as he speaks of their concavity and the caducity of the corolla, it is probable he had not seen it open, and may possibly have merely separated the petals by force to ascertain their form.

As a second genus of an order consisting hitherto but of five species, I subjoin a figure of the plant and the generic character, referring to Meyer's work for a detailed description of the species.

Anthodiscus.

Calyx breviter cupulæformis, margine obscure 5-lobo, persistens. *Petala* 5, concava, arcte cohærentia, disco hypogyno inserta, per anthesin calyptræ more decidua. *Stamina* numerosissima, cum petalis disco hypogyno inserta, basi brevissime monadelpha, interiora breviora, omnia fertilia. *Filamenta* filiformia, tortuosa, minute glandulosa. *Antheræ* ovatæ, biloculares, loculis rima longitudinali dehiscentibus. *Ovarium* liberum, depresso-globosum, radiatim multi- (circiter 14-) loculare, loculis uniovulatis, ovulis peltatis, latere interiore affixis. *Styli* tot quot loculæ ovarii, oblongi, incurvi, stigmatibus oblongis, terminalibus.

Arbor Guianensis. *Folia* alterna, vel opposita, in caule articulata, trifoliolata, foliolis coriaceis lucidis. *Pedicelli* breves, uniflori, bibracteati.

Species unica *A. trifoliatus*. G. W. F. Meyer, l. c. p. 194.

Tab. XX.

Hab. in Guiana Anglica ad ripas fluminum Essequebo et Rupununy. *Schomburgk!* Pl. exs. n. 512.

EXPLANATION OF THE PLATES.

Tab. XVIII.

Symplocos laxiflora.

Fig. 1. Flower.
2. Ditto, with the calyx corolla and removed.
3. Portion of the stamina.
4. Pistillum, with the ovarium cut vertically.
5. Transverse section of the ovarium.
6. Vertical section of the mature fruit.

Tab. XIX.

Seguieria floribunda.

Fig. 1. Diagram of the floral organs.
2. Flower.
3. Stamen.
4. Pistillum, with the ovarium cut vertically.
5. Branch with the fruit.
6. Lower extremity of the seed, with the outer integument removed.
7. Seed.
8. Vertical section of the seed.
9. Embryo.

Tab. XX.

Anthodiscus trifoliatus.

Fig. 1. Flower.
2. Corolla removed.
3. Flower, with the corolla removed.
4. Stamen.
5. Pistillum.
6. Transverse section of the ovarium.
7. Vertical section of ditto.

Miss Drake del.

G. Jarman sc.

XV. *On the existence of* Stomata *in Mosses. In a Letter to* Richard Horsman Solly, *Esq., F.R.S. & L.S. By* William Valentine, *Esq., F.L.S.*

Read April 3rd, 1838.

My dear Sir,

I CANNOT discover any notice of Stomata having been observed on Mosses in any author within my reach*; and Professor Lindley states in his Introduction to Botany, and in his Ladies' Botany, that they are not to be found in this order; and certainly the opinion of their absence is not much to be wondered at, for in by far the greater number of species it is difficult to detect them. Their situation is very remarkable, being confined, with one exception, to the theca. I first detected them whilst examining a section of the theca of *Bryum crudum* with a triplet. It struck me, from the arrangement of the subcutaneous tissue of the apophysis in one spot, that a stoma was above it, and upon scraping off the subcutaneous tissue of a portion of the theca, I discovered the stomata in great numbers on the apophysis. I then examined other species, and found that wherever there was an apophysis they existed, and as in *Bryum crudum*, only on the apophysis. There appeared to be a very good reason why they should not be found on any other spot, for the apophysis appeared to be the only part having sufficient thickness of tissue to allow of the proper arrangement of the subcutaneous cells; and this appeared still more striking after examining the apophyses of several species of *Splachnum*, where they exist in considerable abundance, with one curious exception, *S. ampullaceum*, on whose apophysis they are confined to the upper part, which is the only spot where the subcutaneous tissue has not separated from the cuticle. A more extended examination of species seemed to confirm this opinion, but at length the discovery of their occurrence over the whole of the

* The first discovery of stomata in Mosses is due to Treviranus, who observed them several years ago on the apophyses of *Splachnum sphæricum, mnioides, ampullaceum*, and in several species of *Bryum*. Unger (*Exanth. der Pflanz.* 1833.) has since noticed them in *Bryum turbinatum* and *Bartramia fontana*.

theca of *Encalypta ciliata* proved its fallacy. Besides, in *Encalypta vulgaris* I have since observed several similar exceptions; in the genus *Orthotrichum* and in *Œdipodium Griffithianum* they exist on the upper part of the fleshy seta as well as on the apophysis. In many mosses without apophyses, they are found in a single row at the very base of the theca; for instance, in *Trichostomum patens* and all the Phascums, with the exception of *Phascum alternifolium,* which is destitute of them. Of one hundred and three British species which I have examined, seventy-eight are furnished with stomata. As yet I have discovered no particular condition which is necessary to their existence; they are found equally on the most fully developed species, as *Hypnum rutabulum,* as on the very lowest, of which *Phascum serratum* is the best example; and, on the contrary, they are wanting in species of both extremes, as for instance, *Hypnum denticulatum* and *Phascum alternifolium.* In appearance they are generally similar to those of the most common form amongst Phænogamous plants, as represented at Tab. XXI. fig. 10; occasionally they are so like the surrounding tissue, that the eye would not detect them if they were not the specific object of the examination; and in several species of *Orthotrichum* they are particularly prominent. Their number varies in the different species very considerably, being very numerous on some, as *Funaria hygrometrica,* and as few as four on others, as *Weissia controversa.* The construction of the stomata is for the most part very simple, as in fig. 10, which represents four stomata from the apophysis of *Dissodon splachnoides.* Each stoma is formed of two oblong reniform cells, with their concave sides opposed to each other, by which means an aperture is formed in the cuticle.

Fig. 11. represents a section of one of these stomata. This form appears to be by far the most general, as I have observed only two exceptions. Fig. 1, 2, 3, 4, and 5 represent one of these exceptions, which is confined to five of the British species of *Orthotrichum*; and fig. 7, 8, and 9 the other, which is peculiar to two very nearly allied genera, *Funaria* and *Entosthodon.* The first of these exceptions is remarkable, and as far as I can ascertain, not previously described. In addition to the pair of reniform cells, similar to those of *Dissodon,* the stomata of *Orthotrichum diaphanum, pulchellum, rivulare, anomalum,* and *cupulatum* have a raised border of projecting cells, which form a cavity above the stoma, fig. 4 and 5. These projecting cells have the power of con-

tracting so as to close this cavity, fig. 1. and fig. 2., thereby forming an additional impediment to evaporation or respiration, as the case may be. The nearest approach to this structure is in *Marchantia* and *Targionia*, in which the stomata are formed of several layers of cells, one above the other, and contracting upwards so as to produce a hollow truncated cone.

The obturator ring described by Mirbel does not exist, as was ascertained by Griffith to be the case with *Targionia hypophylla*, but instead there is a quantity of short perpendicular filaments, which project into and form the floor of the cavity of the stoma, and are seated on a dense mass of roundish cells which contain a great quantity of green granules. The species of *Marchantia* which was the subject of Mirbel's observations is not mentioned in Lindley's Botany, one of the tracts published by the Society for the Diffusion of Useful Knowledge; and as my knowledge of this subject is obtained from a second source, you cannot expect it to be so clear as it would have been if I had had the original memoir to consult. If Mirbel describes the obturator ring as common to all the species, he is wrong; but it is more probable that his remarks apply to *polymorpha*, the most common species, and as that is not immediately within my reach, I cannot either confirm or contradict him. There is this important peculiarity in the stomata of *Marchantia conica*—it has not the power of contracting after having been once pervious.

Tab. XXI. fig. 6, 7, 8, and 9 represent the stomata of *Funaria hygrometrica*, each of which consists of a *single* cell in the form of a hollow ring, the sides being so compressed as to convert the aperture into a mere slit. They only occur on the apophysis, which is composed of very loose cellular tissue (excepting its centre), and through the intercellular spaces of this tissue they allow of a communication between the external air and the space between the sporular and thecal membranes. In *Orthotrichum diaphanum* the stomata open directly into this space, and I believe, although I have not been able to prove it, that in all mosses the stomata communicate with this space. All the cells exposed to the action of the air contain green granules; and some, as those forming the external layer of the columella, which have no *apparent* communication with the air, also contain them, although in a less degree, and occasionally a few granules are scattered in the cells which form the substance of the columella, as shown in fig. 1.; the more retired, however, the cells are from the

influence of the air, the fewer are the granules they contain. The size of the cavity between the sporular and thecal membranes varies in different species, and in the same species at different periods of its growth, whilst in some, as *Orthotrichum diaphanum*, these membranes are in contact; in others, of which *Funaria hygrometrica* and *Bartramia pomiformis* are the most marked examples, they are widely distant; this distance, however, is constantly diminishing by the growth of the columella and the gradual development of the sporules.

I shall venture to offer a conjecture as to the use of the stomata in mosses; it is but this moment formed, therefore you cannot expect it to be very matured. In my paper published in the last volume of the Linnean Transactions*, I have endeavoured to prove that the sporules are, in point of fact, pollen, differing from ordinary pollen merely in the greater firmness of its coats, a provision rendered necessary by its immediate exposure to the soil without the intervention of a peculiar apparatus (the ovulum) to prepare it for germination. Now my conjecture is, that the stomata, by admitting the access of the air, do, if not fully cause, at least promote, the hardening of the coats of the sporules. There are some facts which favour this conjecture: the Phascums, with but one exception, have stomata, and as the operculum is persistent, it would appear that there is no other way by which the action of the atmosphere on the sporules can take place; again, they are not found on the Polytrichums nor on *Hymenostomum microstomum*, which are so constructed, the first with a tympanum and closely approximating teeth; the last, in the first instance, with a perfect tympanum, which finally becomes perforated with a minute hole; that after the fall of the operculum, in either instance, the dispersion of the sporules is prevented until the hardening process has taken place. Opposed to these last are the Gymnostomums, in which the sporules would be almost instantly dispersed after the fall of the operculum, and therefore the hardening must be effected before that occurs; and as far as I have yet seen, stomata exist on all the species. The exception in the Phascums, and some few others amongst the peristomed mosses, are at present a stumbling-block; but it is not impossible that future observations may discover either a peculiarity in the hygrometric nature of the peristome, or that the operculum after its de-

* Linn. Trans. vol. xvii. p. 465. *et seqq.*

hiscence is prevented from falling on account of its adhesion with the columella (a common occurrence), which may be a sufficient provision against the premature dispersion of the sporules; or even the tissue in some cases may be so lax in its disposition as to allow of the action of the atmosphere on the internal organs: and I am disposed to believe that this takes place to a considerable extent, from witnessing the presence of green granules in tissue which appeared to have no communication whatever with the air, and from being frequently puzzled to decide whether certain double lines on the cuticle, formed by the walls of two neighbouring cells, are stomata or not: they certainly often appear as competent to perform the imputed function of stomata as the stomata themselves. Although the cause of the green colour of the granules is light, I think I am right in giving the atmosphere a share in the process, for from what other source is the carbon on which the light acts derived? In addition, the theca of *Phascum alternifolium* is thinner and more transparent than that of any other moss, and it is well known that the tissue of mosses is of all other plants the most easily permeable by water, the permeability being in fact so perfect as to make the presence of stomata as exhalants unnecessary; and, finally, stomata are not found in a single instance on the organs of vegetation. So much for what is as yet but a conjecture. You will observe that I have assumed the hardening to be caused by the influence of the atmosphere.

The development of the stomata will be an interesting subject for investigation: all I at present know of the matter is, that in the young state they are very small and much less numerous than when the theca has arrived at maturity; for instance, the average number on the theca of *Orthotrichum diaphanum*, when mature, is from twenty to five and twenty, whilst on the very young theca I have found as few as five, and these were like ordinary stomata, the projecting cells in that early stage not having been developed.

I have some hope that I shall be able to turn these stomata to good account in the arrangement of genera. If I succeed, you shall have the facts in a future letter. I have not yet actually begun my work. I am collecting material which grows almost daily. I shall soon begin a series of drawings illustrating the development of some common moss in all the stages of its

existence; and if my pencil will but do justice to my eye and my knife, I feel confident of being able to produce a most interesting analysis.

I remain, my dear Sir, yours, very truly,

Cae Bwld, near Carnarvon,
March 1st, 1838.

WILLIAM VALENTINE.

EXPLANATION OF TAB. XXI.

Fig. 1. Longitudinal section of the theca of *Orthotrichum diaphanum*. *a.* Operculum. *b.* Theca. *c.* Thecal membrane. *d.* Sporular membrane. *e.* A stoma, the projecting cells of the cuticle being open. *f.* A stoma, the projecting cells of cuticle having closed over the stoma. *g.* Columella. *h.* Sporular cavity. *i.* Pedicel of the columella. *k.* Apophysis. *l.* External peristome—the internal cannot be seen in section. *m.* Metula.

Fig. 2. External view of a stoma from the same. The projecting cells are nearly closed.

Fig. 3. The same. The projecting cells are more open, and allow the true stoma to be seen within.

Fig. 4. Internal view of the same.

Fig. 5. Transverse section of the same. The projecting cells are fully expanded.

Fig. 6. Stomata of *Funaria hygrometrica*—each composed of one cell in the form of a hollow ring.

Fig. 7. Longitudinal section of a young theca of the same plant. *a.* Operculum. *b.* Annulus. *c.* Theca. *d.* Thecal membrane. *e.* Columella. *f.* Sporular membrane. *g.* Sporular sac. *h.* One of the strings of elongated cells which connect the sporular membrane with the thecal membrane;—these only occur in such mosses as have a space between the two membranes in their

young state. *i.* Pedicel of the columella;—most mosses have the pedicel solid. *j.* Loose tissue of the apophysis. *kk.* Stomata opening into the intercellular spaces of the apophysis, through which they communicate with the cavity between the sporular and thecal membranes. *l.* Opercular membrane. *m.* Peristome. *n.* Metula—the opercular membrane of Greville and Arnott.

Fig. 8. Longitudinal section of a stoma, from a dried specimen of the same. *a.* The ring cut through.

Fig. 9. Transverse section of the same.

Fig. 10. Stomata of a dried specimen of *Dissodon splachnoides.*

Fig. 11. Transverse section of a stoma of the same.

Note.—Fig. 1 and 7 are magnified 35 times; all the others are magnified 100 times.

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XVI. *A New Systematic Arrangement of Vertebrated Animals. By* C. L BONAPARTE, *Prince of Musignano, F.M.L.S., &c.*

Read November 7th, 1837.

PRIMAM Regni animalis Provinciam constituunt Animalia Vertebrata: sceleto interno custodienti cerebrum stipitemque nervorum sub cranio et vertebris costas artuumque ossa a musculis protecta regentibus, visceribus cæteris cavitate trunci conclusis. Vasa in apparatu continuo: cor musculare: sanguis ruber: maxilla supra mandibulam incumbens: quinorum organa sensuum, Lingua, Nares, Oculi, Aures, Papillæ; prima quatuor in faciei cavitatibus distincta, ad gustum, olfactum, visum et auditum. Artus non plures quam quatuor. Sexus distincti.

CLASSIUM DISTINCTIO.

1. MAMMALIA. Sanguis calidus: pulmones liberi: mammæ. *Vivipara.*
2. AVES. Sanguis calidus: pulmones affixi: alæ. *Ovipara.*
3. AMPHIBIA. Sanguis frigidus: pulmones liberi. *Ovipara* vel *Ovovivipara.*
4. PISCES. Sanguis frigidus: pulmones nulli: branchiæ. *Ovipara* vel *Ovovivipara.*

CLASSIS I. MAMMALIA.

Animalia vertebrata, sanguine calido, circulatione duplici perfecta, vivipara, pullos lactantia: pulmones bini, imperforati, in pectoris cavitate suspensi: cor biloculare, biauritum: dentes fere in omnibus: corpus utplurimum pilosum: artus, vix paucis exceptis, quatuor manifesti: collo caput fere semper distinctum a trunco.

Ordinum Distributio.

Series 1. *PLACENTALIA.*

Generationis organa ab ano exterius discreta: vagina uniforis: fœta matura: mammæ conspicuæ: ossula ad pubem accessoria nulla: scrotum peni postpositum.

Subclassis 1. EDUCABILIA.

Cerebrum bi- (vel tri-) lobum*.

1. Primates. (*Quadrumana*). Artus quatuor, antici manibus terminati: ungues digitorum apices tantum obtegentes: triplex dentium qualitas; incisivi superiores 2 vel 4; molares tritorii: mammæ pectorales: penis liber, pensilis.
2. Feræ. (*Carnivora.*) Artus quatuor liberi, exporrecti, distincti, gradientes, ungues digitorum apices tantum obtegentes: triplex dentium qualitas; molares trimorphi, antici sectorii, postici sine tuberculis acutis; ferinus utrinque saltem unus, laniarii duo validi, et incisivi sex in utraque maxilla: mammæ abdominales: penis inclusus vagina abdomini adhærente.
3. Pinnipedia. (*Amphibia.*) Artus quatuor, brevissimi, retracti, obvoluti, pinniformes; postici longiores, reversi, invicem proximi: ungues digitorum apices tantum obtegentes: triplex dentium qualitas: mammæ abdominales: penis vagina abdomini adhærente inclusus.
4. Cete. (*Natantia.*) Artus duo, posticis nullis, pinniformes: caput deficiente collo indistinctum: corpus pisciforme, caudaque ligamentosa horizontali pinniformi terminatum. *Aquatica; auriculis, pilisque destituta.*
5. Belluæ. (*Pachydermata.*) Artus quatuor; claviculæ nullæ; antibrachium constanter pronum: ungues sculponei, digitorum phalanges extremas obvolventes: dentium qualitas sæpius triplex: stomachus simplex, aut licet compositus ruminationis impotens.
6. Pecora. (*Ruminantia.*) Artus quatuor, bisulci; claviculæ nullæ; antibrachium constanter pronum: ossa metacarpi et metatarsi connata: ungues

* A constructione cerebri, scilicet a loborum, quibus organum illud nobilissimum constet, quantitate, Mammalium distributionem laudabiliter peti posse didicimus in Museo naturali Lugdunensi, cui meritissime præest cl. Jourdanus, qui jam diu animale Regnum juxta nervorum vitalissimam conditionem examinandum suscepit. Confectum hujusmodi Systema quam primum in lucem proferri nemo est qui non cupiat. Divisionem vero in *Placentalia* atque *Ovovivipara*, etsi ab aliis adumbratam, certis limitibus hodie conclusam cl. Oweno, Anglo, debemus.

sculponei, digitorum phalanges extremas obvolventes: dentium qualitas raro triplex: ventriculis quatuor ruminantia.

Subclassis 2. INEDUCABILIA.

Cerebrum unilobum.

7. Bruta. (*Edentata.*) Artus quatuor liberi; ungues digitorum summitatem obvolventes, conici, fere sculponei: dentes radicibus destituti, aut duplicis aut unicæ qualitatis, aut nulli; incisivi nulli; ubi molares 14—98.

8. Cheiroptera. (*Volitantia.*) Artus quatuor, antici, digitis longissimis (dempto brevissimo pollice), membrana nuda ad pedes usque producta aliformi conjunctis: ungues digitorum apices tantum obtegentes: triplex dentium qualitas, incisivi superiores 0—2—4: mammæ duo pectorales: penis liber, pensilis. *Nocturna.*

9. Bestiæ. (*Insectivora.*) Artus quatuor liberi, manibus non terminati: ungues digitorum apices tantum obtegentes: triplex dentium qualitas; molares dimorphi, ferinis nullis; antici spurii, postici tuberculis acutis pluribus coronati, supra subtusque hinc inde quatuor: incisivi 2—6: mammæ plures abdominales: penis vagina abdomini adhærente inclusus.

10. Glires. (*Rosores.*) Artus quatuor: ungues digitorum apices tantum obtegentes: duplex dentium qualitas, laniariis nullis; incisivi infra supraque duo, elongati, superioribus quandoque duo accessorii additi: molares ad summum 24, tritorii: mandibulis horizontaliter promotis rosores.

Series 2. *OVOVIVIPARA.*

Generationis organa ab ano exterius haud discreta: fœta abortiva, extra uterum maturanda: mammæ inconspicuæ: ossula ad pubem duo accessoria: scrotum præpositum peni retroverso. *aut nullum.*

11. Marsupialia. (*Didelpha.*) Artus quatuor, gradientes, postici sæpe manibus terminati: ungues digitorum apices tantum obtegentes: dentes alveolares, duplicis aut triplicis qualitatis: fœminarum mammæ marsupio abdominali, vel ejus rudimentali plica, absconditæ: vagina biforis.

12. Monotremata. (*Reptantia.*) Artus quatuor, aut natatores aut fossores: ungues digitorum apices tantum obtegentes: dentes alveolares nulli: cloaca excretionis simul ac generationis organa intra se continens: marsupium abdominale nullum: vagina uniforis.

Contrahendo nunc characteres adeo ut uno oculi ictu inspiciamus qualem Mammalium classis *distributionem* obtineat meliorem ex antea scriptis, tabellam hanc simplicissimam exaravimus.

MAMMALIA.

Series 1. *PLACENTALIA.*

Subclassis 1. EDUCABILIA.

1. Primates. *Artus antici manus.*
2. Feræ. Molares sectorii, canini validi.
3. Pinnipedia. Artus pinniformes.
4. Cete. Corpus pisciforme.
5. Belluæ. Ungulata, *haud* ruminantia.
6. Pecora. Ungulata ruminantia.

Subclassis 2. INEDUCABILIA.

7. Bruta. Subungulata, imperfecte dentata.
8. Cheiroptera. Artus antici aliformes.
9. Bestiæ. Molares cuspidati.
10. Glires. Incisivis elongatis rosoria.

Series 2. *OVOVIVIPARA.*

11. Marsupialia. Mammæ occultæ.
12. Monotremata. Cloaca.

Conspectus Familiarum et Subfamiliarum.

Series 1. *PLACENTALIA.*

Subclassis 1. EDUCABILIA.

Ordo 1. PRIMATES.

1. Hominidæ. Artuum tantum antici in manus desinentes pollice cuique digito opponibili.
    1. *Hominina.* Corpus erectum, plantigradum, ecaudatum.
2. Simidæ. Artus singuli in manus desinentes, pollice, saltem in posticis, cui-

que digito opponibili: dentes incisivi plus minus erecti infra supraque quatuor: vultus denudatus. *Anthropomorpha.*

2. *Simina.* Manus singulæ pollice cuique digito opponibili: dentes infra supraque hinc inde quinque tuberculati: nares approximatæ: ungues breves, depressi.

3. *Cebina.* Manus singulæ, anticis interdum imperfectis, pollice cuique digito opponibili: dentes molares infra supraque hinc inde sex, tuberculati: nares inter se remotæ: ungues breves, depressi.

4. *Hapalina.* Manus tantum posticæ pollice cuique digito opponibili: dentes molares infra supraque hinc inde quinque, cuspidati: nares inter se remotæ: ungues longissimi, arcuati, compressi, acuti.

3. Lemuridæ. Artus singuli in manus desinentes, pollice cuique digito opponibili: dentes incisivi procumbentes, aut supra vel infra plusquam quatuor: molares cuspidati: vultus pilosus: nares terminales, sinuosæ. *Feriformia.*

5. *Lemurina.* Artus caudaque liberi.

6. *Galeopithecina.* Artus antici membrana villosa cum posticis caudaque conjuncti.

Ordo 2. FERÆ.

4. Cercoleptididæ. Mammæ duo tantum, inguinales: lingua longissima, extensilis: cauda prehendens, tota hirsuta.

7. *Cercoleptidina.* Dentes 36, sex nempe incisivi, duo laniarii, molares decem, spuriis 4, in utraque maxilla. *Anomala. Primates frugivoros cum Bestiis conjungit.*

5. Ursidæ. Dentes molares postici tritores: pedes plantigradi, plantis denudatis: ungues obtusiculi.

8. *Ursina.* Dentes incisivi mandibulæ ad lineam collocati: ungues scansorii.

9. *Melina.* Dentes incisivi mandibulæ extra lineam collocati: ungues fossores.

6. Felidæ. Dentes molares posteriores, demptis postremis minoribus, sectorii: pedes plerumque digitigradi, plantis pilosis: ungues acutissimi.

10. *Viverrina.* Dentes molares tuberculati utrinque bini post carnivorum supra, infra unus: lingua aspera: folliculus glandulosus pone anum.

11. *Canina.* Dentes molares tuberculati utrinque bini post carnivorum infra supraque: lingua lævis.

12. *Felina.* Dentes molares tuberculati nulli in mandibula: lingua aspera.

13. *Mustelina.* Dentes molares tuberculati in utraque maxilla: unus post carnivorum utrinque supra: lingua lævis: pedes congrui: cauda tereticula. *Corpus elongatum, gracile, ductile: pedes breves.*

14. *Lutrina.* Dentes molares tuberculati, utrinque unus post carnivorum infra supraque: lingua scabricula: pedes subretracti, subobvoluti, postici laterales podio antrorsum verso: cauda applanata.

Ordo 3. PINNIPEDIA.

7. Phocidæ. Dentes laniarii mediocres, inclusi: mammæ duæ ventrales.

15. *Otarina.* Auriculæ prominulæ: dentes incisivi superiores bicultres, inferiores bicuspides: digiti palmarum immobiles; ungues plani.

16. *Phocina.* Auriculæ vix ullæ: dentes incisivi acuti: digiti singuli mobiles, ungues acuti.

8. Trichechidæ. Dentes laniarii longissimi, producti, validi, in maxilla tantum: mammæ quatuor ventrales.

17. *Trichechina.* Auriculæ nullæ: rostrum brevissimum, obtusum: nares superæ: dentes incisivi supra duo minuti, infra nulli. *Corpus obesum.*

Ordo 4. CETE.

9. Manatidæ. Dentes molares compositi aut semi-compositi, corona plana aut sulcata: mammæ pectorales: spiracula nulla: intestinum cæcum. *Phytophaga.*

18. *Manatina.* Artus fere brachiiformes, plerumque unguiculati.

10. Delphinidæ. Dentes simplices, conici: artus prorsus pinniformes, exunguiculati: mammæ inguinales: spiracula: caput vel mediocre vel parvum: cæcum nullum. *Zoophaga.*

19. *Delphinina.* Dentes sæpius numerosi infra supraque.

20. *Monodontina.* Dentes tantum duo, prælongi, acuti, ex tortili fabrica, osse maxillari infixi (uno sæpius abortivo).

11. Physeteridæ. Dentes numerosi, simplices, conici: artus prorsus pinniformes, exunguiculati: caput immane: cæcum nullum?

21. *Physeterina.* Dentes inferiores a totidem maxillæ foveis excipiendi: superiores parvuli, absconditi.

12. Balænidæ. Dentes nulli: cæcum parvum.

22. *Balænina.* Laminæ corneæ binæ in maxilla inæqualiter pectinatæ os hinc inde occludentes loco dentium.

Ordo 5. BELLUÆ.

13. Elephantidæ. Digiti sub tegumentis reconditi, ungue tantum dignoscendi.

23. *Dinotherina.* Pedes pentadactyli: dentes molares coronide transversim sulcata; incisivi infra duo prælongi, deflexi.

24. *Elephantina.* Pedes pentadactyli: dentes molares utrinque bini maximi, lamellosi aut mamillosi: nasus proboscideus.

14. Suidæ. Digiti ad apicem saltem fissi.

25. *Hippopotamina.* Pedes tetradactyli: dentes molares complicati, numerosi: chiloma latum, obtusum.

26. *Rhinocerontina.* Pedes tridactyli: dentes molares complicati, numerosi: nasus corniger.

27. *Tapirina.* Pedes antici tetradactyli, postici tridactyli: digiti cute obvoluti, ad apicem fissi: nasus productus, mobilis.

28. *Suina.* Pedes tetradactyli, postici interdum tridactyli: digiti insessores constanter duo: nasus subproboscideus.

29. *Anoplotherina.* Pedes didactyli.

15. Hyracidæ. Digiti artuum anticorum quatuor, posticorum tres, omnes cute obvoluti, apice fissi: ungues lamellares.

30. *Hyracina.* Digitus artuum posticorum internus ungue curvo munitus: cutis dense pilosa: dentes incisivi supra duo. *Gliribus accedentia.*

16. Equidæ. Pedes tridactyli duobus digitis abortivis lateralibus absconditis: principalis solida ungula convallatus.

31. *Equina.* Corpus dense pilosum, collo caudaque longe crinitum: dentes incisivi infra supraque sex.

Ordo 6. PECORA.

17. Camelidæ. Dentes laniarii infra supraque: duo incisivi supra, infra sex: cornua nulla.

32. *Camelina.* Rostrum productum : sinus lacrymales nulli : pedes subtus callosi, digitis cute obvolutis, solo apice bisulci.

18. CERVIDÆ. Dentes laniarii infra nulli ; incisivi supra nulli, infra octo : cornua in maribus fere ordinaria, rarissima in fœminis, caduca, solida, pedunculata, ramosa, cuticula villosa, temporaria saltem, induta.

33. *Moschina.* Dentes laniarii duo producti, supra in maribus : sinus lacrymales nulli : cornua nulla : folliculus præputialis moschifer !

34. *Cervina.* Dentes laniarii plerumque nulli : sinus lacrymales sæpius magni : cornua in maribus.

19. CAMELOPARDALIDÆ. Dentes laniarii nulli : incisivi supra nulli, infra octo : cornua in utroque sexu, perennia, solida, brevia, simplicia, cuticula villosa induta.

35. *Camelopardalina.* Dentes molares utrinque sex contigui : pedes prorsus bisulci.

20. BOVIDÆ. Dentes laniarii nulli : incisivi supra nulli, infra octo : cornua perennia, sæpius in utroque sexu, ex osse frontali producta, elastico tegumento vaginata.

36. *Antilopina.* Cornua solida.

37. *Bovina.* Cornua cavernosa.

Subclassis 2. INEDUCABILIA.

Ordo 7. BRUTA.

21. MYRMECOPHAGIDÆ. Dentes nulli : os perexiguum : lingua angusta, emissilis.

38. *Myrmecophagina.* Corpus pilosum : ungues antici validi, margine acuto.

39. *Manidina.* Corpus squamosum.

22. DASYPODIDÆ. Dentes : laniarii nulli : molares 26—98 : rostrum productum.

40. *Dasypodina.* Corpus cataphractum.

41. *Orycteropodina.* Corpus pilosum.

23. BRADYPODIDÆ. Dentes : incisivi nulli : molares non ultra 18 : rostrum breve : artus antici longiores.

42. *Bradypodina.* Corpus villosum: dentes laniarii acuti: mammæ duo, pectorales! digiti cute juncti: ungues maximi, falculares.

Ordo 8. CHEIROPTERA.

24. Pteropodidæ. Dentes molares, aut obtuse tuberculati, aut læves; incisivi parvi, inanes, inter validos laniarios stipati: digitus index omnium phalangium numero absolutus, unguiculatus. *Frugivora, Gregaria.*

43. *Pteropodina.* Nasus simplex: nares tubulosæ: labia tenuia: tragus nullus: caput conicum: unguis digiti indicis plerumque acutus: membrana interfemoralis brevissima: cauda vel brevissima vel nulla.

25. Vespertilionidæ. Dentes molares tuberculis acutis coronati: nullus alaris digitus omni phalangium numero absolutus: index exunguiculatus. *Insectivora.*

44. *Noctilionina.* Nasus simplex: labia magna, prolapsa: cauda brevis, crassa, apice libera.

45. *Vespertilionina.* Nasus simplex: labia congrua: cauda longa, membrana interfemorali ampla obvoluta.

46. *Rhinolophina.* Nasus appendice foliacea complicata: tragus nullus.

47. *Rhinopomina.* Nasus appendice foliacea simplici: tragus distinctus.

26. Vampyridæ. Dentes molares tuberculis acutis coronati: tertius tantum alaris digitus omni phalangium numero absolutus: index exunguiculatus. *Insectivora.*

48. *Vampyrina.* Nasus appendice foliacea simplici: tragus distinctus.

Ordo 9. BESTIÆ.

27. Talpidæ. Artus antici fossores.

49. *Talpina.* Rostrum productum.

28. Soricidæ. Artus singuli vel ambulatores vel natatores: cutis pilosa.

50. *Macroscelididina.* Rostrum proboscideum: dentes incisivi infra quatuor, supra sex; canini nulli: artus postici anticis valde longiores.

51. *Soricina.* Rostrum attenuatum: dentes incisivi infra supraque duo: canini nulli: auriculæ: pedes fissi.

52. *Myogalina.* Rostrum proboscideum: dentes incisivi infra quatuor, duo supra; canini nulli: auriculæ nullæ: pedes palmati.

53. *Cladobatidina.* Rostrum elongatum: dentes incisivi infra sex, quatuor supra; canini nulli: artus æquilongi: ungues adunci, acutissimi.

29. Erinaceidæ. Artus singuli ambulatores: cutis spinosa.

54. *Centetina.* Corpus haud conglobabile: dentes canini.

55. *Erinaceina.* Corpus conglobabile: cauda brevissima: dentes canini nulli.

Ordo 10. GLIRES.

30. Muridæ. Claviculæ perfectæ: dentes molares simplices.

56. *Echymydina.* Cauda squamata: vellus aculeis mixtum.

57. *Murina.* Cauda squamata: vellus setis mixtum.

58. *Dipodina.* Cauda longissima, apice floccifero: pedes saltatorii, antici breves, postici longissimi.

59. *Sciurina.* Cauda longa, villosa, sæpius disticha: vellus molle, uniforme: pedes æquilongi.

60. *Arctomydina.* Cauda vel brevis vel nulla: vellus molle, subuniforme: pedes æquilongi.

61. *Aspalacina.* Cauda brevis: vellus rude: pedes breves; anticorum ungues fossores: oculi auresque exigui: dentes incisivi prælongi, manifesti.

31. Castoridæ. Claviculæ perfectæ: dentes molares compositi.

62. *Arvicolina.* Dentes molares radicibus destituti, lamellosi. *Herbivora.*

63. *Castorina.* Dentes molares radicibus instructi.

32. Cheiromydidæ. Claviculæ perfectæ: mammæ duo, inguinales: cauda longissima.

64. *Cheiromydina.* Pedes pentadactyli, digito medio elongato, gracillimo, nudo: postici desinentes in manus pollice ungue laminari cuique digito opponibili.

33. Hystricidæ. Claviculæ imperfectæ: corpus spinosum; dentes incisivi duo supra: pedes antici tetradactyli, postici pentadactyli.

65. *Hystricina.* Dentes molares coronide plana sublamellosi: lingua hispida.

34. Leporidæ. Claviculæ imperfectæ: corpus pilosum: dentes incisivi supra quatuor (in junioribus sex): pedes antici tetradactyli, postici pentadactyli.

66. *Leporina.* Corpus plantæque pilosæ: dentes molares lamellosi.

35. Lagostomidæ. Claviculæ imperfectæ: corpus mollissime, uniformiter villosum: dentes incisivi duo supra: pedes antici breves, postici elongati.

67. *Lagostomina.* Dentes incisivi inferi canaliculati: cauda pectinata.

36. Cavidæ. Claviculæ imperfectæ: corpus pilosum: dentes incisivi duo supra; molares sexdecim: pedes postici, vel tridactyli, vel pentadactyli, utroque digito laterali minimo.

68. *Cavina.* Dentes molares radicibus destituti, lamellosi.

69. *Dasyproctina.* Dentes molares compositi.

Series 2. *OVOVIVIPARA.*

Ordo 11. MARSUPIALIA.

37. Halmaturidæ. Dentes in modum plus minus *Glirum*: incisivi elongati; carnivori nulli: molares tuberculis coronati.

70. *Phascolomydina.* Dentes in modum penitus *Glirum*: incisivi elongati infra supraque duo; laniarii nulli, vel tantum supra, exigui; molares tuberculis transversis duobus: caput grande, depressum: artus breves: ungues fossores: cauda nulla.

71. *Halmaturina.* Dentes incisivi duo infra longi, lati, acuti, sex supra: laniarii infra saltem nulli: artus antici brevissimi, postici longissimi, digitis duobus conjunctis, pollice nullo: cauda fulciens.

72. *Petaurina.* Dentes incisivi duo infra longi, lati, acuti, sex supra: laniarii longi, acuti supra; exiles, latentes infra, vel nulli: artus æquilongi digitis duobus conjunctis, pollice grandi, exungui, fere retroverso: cauda prehendens.

38. Didelphidæ. Dentes in modum *Bestiarum*: ferini nulli: molares tuberculis acutis coronati utrinque tres vel quatuor.

73. *Didelphina.* Artus postici in manus pollice cuique digito opponibili desinentes: cauda prehendens partim nuda: dentes incisivi decem supra, infra octo: lingua hispida.

39. Thylacinidæ. Dentes in modum *Ferarum*: infra supraque carnivori quatuor.

74. *Thylacinina.* Artus postici pollice nullo: cauda pilosa: dentes 46. *Omnium Ferarum ipsissimarum magis carnivora ratione dentium.*

Ordo 12. MONOTREMATA.

40. Echidnidæ. Corpus spinosum: rostrum cylindraceum, attenuatum: pedes fossores.

75. *Echidnina.* Aculei parvi palato affixi loco dentium: lingua emissilis.

41. Ornithorhynchidæ. Corpus pilosum: rostrum valde depressum, latum (anatinum): pedes palmati.

76. *Ornithorhynchina.* Dentes molares utrinque duo infra supraque: lingua lata, mollis, carnosa.

Classis II. AVES.

Animalia vertebrata, sanguine calido, circulatione duplici, ovipara, volatilia: pulmones bini indivisi, cribrosi, costis adhærentes: cor biloculare, biauritum: rostrum corneum, dentibus destitutum: corpus plumosum: sternum fere in omnibus carinatum: os furculæ: alæ pedesque duo.

Ordinum Distributio *.

Subclassis 1. INSESSORES.

Digitus posticus (pollex, sive digitus externus retroversus) eodem plano ac antici insertus, totus solo insistens, constrictor. *Monogamæ fere omnes: pullorum imbecillium altrices.*

* Distribuere avium classem in plures quam octo ordines naturales conabar. Inutilis sane labor, a quo discessi. Quis enim *Accipitres* cum cæteris potius *Insessoribus* conjungendos, quis *Gallinas* in plures ordines discindere audeat? *Anseres* quidem in quatuor distribuerentur facile, in *Anseres* genuinas videlicet, in *Pelecanos*, in *Gavias*, in *Urinatores*: *Grallarum* vero (*Struthionibus* demptis) subdivisio alia omnino non obtinet. Si *Passerum* inde spectemus universitatem, præter *Psittacos* sine dubio *Primates*, præter *Columbas* quæ *Passeres* cum *Gallinis* conjungunt, *Trochilos*, *Picos*, *Coccyzesque* etiam segregarem libenter, majus quoties lucrum in scientiam redundaret. Quid enim intererit, quæso, familias hasce, utpote notabiliores, in ordines elevare, cæteris in acervum quoddam indigestum manentibus?

1. Psittaci (*Prehensores*). Digiti bini antici, binique postici: tarsi reticulati: rostrum aduncum, cerigerum ad basim.
2. Accipitres (*Rapaces*). Digiti tres antici, unus posticus: rostrum aduncum, cerigerum ad basim: nares patulæ: ungues retractiles.
3. Passeres (*Volucres*). Digiti, vel tres antici unusque posticus, vel bini antici, binique postici: tarsi scutati: rostrum nec aduncum nec cerigerum.
4. Columbæ (*Giratores*). Digiti tres antici, unus posticus: rostrum fornicatum, ceromate molli tumescente ad basim.

Subclassis 2. GRALLATORES.

Digitus posticus (pollex) altius tarso insertus quam antici, parum vel nihil solo insistens, minime constrictor, aut nullus. *Tectrices alarum magnæ. Polygamæ pleræ: pullorum alacrum ac per se victitantium educatrices.*

5. Gallinæ (*Rasores*). Tarsi teretes, validi, breviculi: tibiæ totæ plumosæ, una cum apice femoris exsertæ: rostrum breve, fornicatum. *Plumæ compactæ.*
6. Struthiones (*Ratitæ*). Tarsi teretes, validi, longi: tibiæ seminudæ, una cum apice femoris exsertæ: rostrum vel breve vel elongatum: sternum ecarinatum! alæ impennes! *Plumæ laceræ, laxissimæ.*
7. Grallæ (*Cursores*). Tarsi teretes, tenues, elongati: tibiæ fere semper seminudæ, una cum apice femoris exsertæ: rostrum utplurimum elongatum. *Plumæ compactæ.*
8. Anseres (*Natatores*). Tarsi compressi, breves: tibiæ fere semper seminudæ, earumque bases una cum toto femore insertæ: pedes palmati. *Plumæ densissimæ, compactæ, oleosæ, lanugine ad basim circumseptæ.*

Conspectus Familiarum et Subfamiliarum.

Subclassis 1. INSESSORES.

Ordo 1. PSITTACI.

1. Psittacidæ. Lingua crassa, carnosa: digiti non versatiles; antici distincti: tectrices alarum magnæ.

1. *Macrocercinæ.* Rostrum maxilla valde uncinata, mandibula valde profundior quam lata: cauda longissima, cuneata.
2. *Psittacinæ.* Rostrum maxilla conspicue dentata, mandibula minus profunda quam longa: cauda brevis, vel truncata, vel rotundata.
3. *Plyctolophinæ.* Rostrum perbreve, latissimum, culmine mirifice incurvum: caput magnum crista explicabili: cauda elongata, lata, rotundata, rectricibus largiculis.
4. *Lorinæ.* Rostrum leviter incurvum; maxilla margine sinuata, vix emarginata; mandibula gracili, conica, valde longiore quam profunda, gonyde recta.
5. *Pezoporinæ.* Rostrum validum, solidum, dentatum, culmine valde convexo; mandibula brevissima, profunda, gonyde curva: tarsus exilis, digito postico longior; digiti graciles: cauda longa latissima, valde cuneata.

Ordo 2. ACCIPITRES.

2. Vulturidæ. Caput subnudum, plumulis raris obsitum: oculi laterales: tarsus digito medio brevior: pollex subelevatus: ungues parum curvi, vix retractiles: alæ magnæ.

6. *Vulturinæ.* Rostrum minime dentatum, cera glabra.
7. *Gypaetinæ.* Rostrum elongatum, minime dentatum, cera setis tecta.

3. Gypogeranidæ. Caput plumis densis tectum: oculi laterales: tarsus plus duplo longior digitis anticis.

8. *Gypogeraninæ.* Rostrum breve, crassum, rictu amplo: alæ spina armatæ.

4. Falconidæ. Caput plumis densis tectum: oculi laterales: cera patens: tarsus mediocris: pollex validus, insistens.

9. *Polyborinæ.* Rostrum breviculum, sinuatum: facies plus minus nuda: pedes tenues, tarsus digito medio vix longior: digiti laterales æquilongi: alæ magnæ, remigibus tertia et quarta omnium longissimis.
10. *Aquilinæ.* Rostrum longiculum, recticulum ad basim, sinuatum: pedes validissimi: ungues robusti, valde adunci: alæ magnæ, elongatæ, remigibus primis gradatis, quarta omnium longissima.
11. *Buteoninæ.* Rostrum mediocre, crassum ad basim, vix sinuatum: cera

valde protensa: pedes modici, pollice brevi: alæ elongatæ, remigum quarta omnium longissima: cauda modica.

12. *Milvinæ.* Rostrum parvulum, crassum ad basim, sinuatum: cera protensa: pedes breves, pollice breviculo: alæ longissimæ, remigum quarta vel tertia vel secunda omnium longissima: cauda elongata.

13. *Falconinæ.* Rostrum breve, a basi abrupte incurvum, apice utrinque dentatum: cera brevis: nares rotundæ, pistillatæ: pedes mediocres, tarso tenui, nudo, digito medio longissimo, pollice brevissimo: alæ elongatæ, acutæ, remigum secunda omnium longissima.

14. *Accipitrinæ.* Rostrum breve, a basi abrupte incurvum, sinuatum: pedes modici, tarso nudo, digito medio longissimo, postico parum breviore quam interior: unguis internus externo subduplus: alæ breves, remigum quarta omnium longissima.

15. *Circinæ.* Rostrum parvulum, rictu amplo, compressum, ad basim profundum, vix sinuatum: cera ad medium protensa: pedes elongati, graciles, nudi: alæ elongatæ, remigum tertia seu quarta omnium longissima.

5. Strigidæ. Caput ingens plumis densis tectum: oculi magni, faciales: cera obsoleta: rostrum breve, compressum: pedes plumulosi, digitis fissis, externo versatili.

16. *Surninæ.* Caput modicum: discus facialis, intraocularis tantum, obsoletus: aures parvulæ, inoperculatæ.

17. *Buboninæ.* Caput grandiculum: discus facialis, intraocularis tantum, imperfectus: aures mediocres, inoperculatæ.

18. *Ululinæ.* Caput grande: discus facialis, oculos excedens, perfectus: aures grandes, operculatæ.

19. *Striginæ.* Caput immane: rostrum elongatum, ad basim recticulum: discus facialis, oculos excedens, maximus, excultissimus: aures ingentes, late operculatæ.

Ordo 3. PASSERES.

* *Tribus* I. *Ambulatores.* Digiti tres antici, unus posticus.

6. Caprimulgidæ. Rostrum brevissimum, depressum, ad basim dilatatum, rictu immani: pedes brevissimi, graciles; digiti antici basi diver-

gentes, membrana juncti; pollice versatili; unguis medius intus oblique dilatatus: alæ magnæ rotundatæ, pennis cubiti magnis: plumæ omnes laxæ, mollissimæ.

20. *Podarginæ.* Rostrum grandiculum, validiculum: unguis medius margine integer: pollex normaliter situs.

21. *Caprimulginæ.* Rostrum exillimum, lateribus inflexum: tarsus brevis; pollex contraversus; digitus exterior et interior æquilongi: unguis medius pectinatus.

22. *Scorthornithinæ.* Rostrum exillimum, lateribus inflexum: tarsus brevis; pollex contraversus; digitus exterior interiore brevior: unguis medius pectinatus.

7. Cypselidæ. Rostrum brevissimum depressum, triangulare, tenue, dilatatum ad basim, gonyde adscendente, marginibus inflexis, rictu amplissimo: pedes exiles, brevissimi, digitis anticis subæquilongis: alæ perlongæ, falcatæ, tectricibus mediocribus pennas cubiti brevissimas abscondentibus: plumæ omnes strictæ, nitentes.

23. *Cypselinæ.* Digiti omnino fissi; pollex debilis, versatilis: ungues magni, valde curvati.

8. Hirundinidæ. Rostrum breve, usque a basi depressum, tenue, marginibus minime inflexis, rictu amplo, glabro, vibrissis nullis: pedes breves: digiti subliberi, laterales æquilongi; medius tarso longior: alæ elongatæ, tectricibus parvis, pennis cubiti longiculis: plumæ omnes strictæ, nitentes.

24. *Hirundininæ.* Pollex brevior quam digitus internus; unguis unus medius, acie interna integerrima.

9. Ampelididæ. Rostrum breve, depressum, ad basim dilatatum, apice emarginatum, deflexum; sutura arcuata, gnathidiis humilibus verticalibus, carina rotundata; rictus amplissimus: alæ, remigibus primariis decem, pedesque mediocres: plantæ planæ.

25. *Ampelidinæ.* Rostrum exile, gonyde haud adscendente: rictus lævis: nares grandes, membranula postice clausæ: digiti laterales inæquales, exteriore cum mediano conjuncto: tarsus squamulis lateralibus numerosis, reticulatis: alæ modice elongatæ, amplæ, remige prima breviore quam secunda.

26. *Bombycillinæ.* Rostrum breve, durum, latum, subteres quasi triangulare, mandibula validicula, gonyde adscendente: rictus lævis: nares rotundatæ absque membrana, plumularum vellere semiclausæ: pedes validiculi, breves; digiti laterales subæquilongi: alæ elongatæ, acutæ, remige prima longioribus æquali.

27. *Gymnoderinæ.* Rostrum sub oculos usque fissum; nares absque membrana: facies jugulumque subnuda! plumæ capitis breves vel nullæ: tarsi scutis fere novem, prominulis, subæqualibus: digiti subliberi, laterales inæquales; pollex brevior quam digitus internus.

28. *Querulinæ.* Rostrum validum, latum, valde depressum; rictu setis rigidis instructo: digiti laterales inæquales, exteriore cum mediano conjuncto: tarsus squamulis lateralibus minutis.

29. *Eurylaiminæ.* Rostrum breve, rectum, enormiter latissimum; maxilla valde convexa, dilatata ad basim, marginibus mandibulam amplectentibus, apice abrupte inflexo: pedes validiculi: digito externo cum mediano semiconjuncto; postico longiculo, interno omnibus breviore: alæ breviculæ: cauda brevis.

10. Coraciadidæ. Rostrum breviculum, rectum, lateribus valde compressis, dilatatum, apice incurvo: rictus amplissimus, barbatus: nares lineares: pedes breves, digitis sejunctis, anticis ad basim parallelis, postico valde breviore.

30. *Coraciadinæ.* Lingua apice fimbriata: alæ mediocres.

11. Prionitidæ. Rostrum mandibula utraque subincurva, compressum, marginibus denticulatis: digiti antici ultra medium concreti.

31. *Prionitinæ.* Lingua longa, gracilis, margine ciliata: alæ breves, rotundatæ: cauda longa, cuneata.

12. Alcedinidæ. Rostrum subquadrangulari-acuminatum, rectum; rictu amplo: pedes parvuli, digitis externis ultra medium concretis: tibiæ seminudæ! alæ breves, rotundatæ.

32. *Dacelininæ.* Rostrum cylindraceum, ad basim depressum, lateribus dilatatum, gonyde adscendente: lingua brevis, apice triangulari.

33. *Alcedininæ.* Rostrum a basi compressum, apice acutum, sutura rectissima: lingua brevis, apice triangulari.

13. Meropidæ. Rostrum subquadrangulari-acuminatum, subcurvatum; rictu

amplo: tibiæ seminudæ: pedes minuti; digitis externis ultra medium concretis: alæ elongatæ, acutæ.

34. *Meropinæ.* Lingua angusta, apice lacero.

14. UPUPIDÆ. Rostrum elongatum, gracile, curvatum, valde compressum, intus parum excavatum; marginibus integris oppositis; sutura elongata, recta: lingua brevissima, triangularis, obtusa, integerrima: digiti grandiculi, crassiculi, internus multo brevior, externus cum mediano semiconjunctus: ungues parvi, minime incurvi: alæ amplæ.

35. *Upupinæ.* Maxillæ intus perfecte planæ: unguis posticus recticulus: cauda brevis, truncata.

36. *Promeropinæ.* Maxillæ intus aliquantulum concavæ, marginibus acutis: unguis posticus curvus: cauda longa, cuneata.

15. PARADISÆIDÆ. Rostrum grandiculum, cultratum, subemarginatum, sub oculos usque fissum: capistrum plumulis holosericeis densis nares occultantibus: pedes maximi, cute molli, vix scutata tecti; digiti tenues, elongati, internus multo brevior, a basi divergens, externus articulo sesquialtero concretus; pollex maximus.

37. *Paradiseinæ.* Lingua acuta, apice laciniata: alæ longæ, amplæ: pennæ hypochondriacæ elongatissimæ.

16. MELLIPHAGIDÆ. Rostrum longum, modice gracile, emarginatum: pedes validiculi, digito postico elongato.

38. *Melliphaginæ.* Lingua longe extensilis, membranacea, apice penicillato.

17. CYNNIRIDÆ. Rostrum longum, gracile, plus minus curvum, integrum: nares breves, ovales, membranaceæ, rima laterali apertæ: pedes modici: alæ mediocres, remigibus primis plus minus gradatim abbreviatis.

39. *Cerebinæ.* Rostrum tenue, subcompressum: lingua longe extensilis, longe ciliata.

40. *Cynnirinæ.* Rostrum longum, tenue, minime compressum: lingua longe extensilis, membranacea, glabra.

18. TROCHILIDÆ. Rostrum longum, gracillimum; rictu minimo: lingua vibratilis, tubulosa, suctoria: pedes exigui: alæ longissimæ, falcatæ.

41. *Trochilinæ.* Rostrum tereticulum, tomiis maxillaribus mandibularia

amplectentibus, myxa brevissima: digiti basi connati, subtus plani: ungues parvuli.

19. CERTHIDÆ. Rostrum longulum, compressum, integrum: lingua elongata, non extensilis, apice cartilagineo: pedes breviculi: digiti elongati, validi, compressi: pollex validissimus; ungues grandes, arcuati, acuti: cauda cuneata.

42. *Tichodrominæ.* Rostrum integerrimum; membrana narium nuda, fornicata: tarsus digito postico breviculo longior; digiti laterales subæquilongi a basi disjuncti: cauda mollis, brevicula.

43. *Thryothorinæ.* Rostrum subemarginatum, membrana narium fornicata: digiti antici ad basim adnati: cauda rotundata, vel gradata, brevicula, mollis.

44. *Certhinæ.* Rostrum plus minus curvum, valde compressum: lingua acuminata: digiti antici ad basim conjuncti: rectrices rigidæ, rachide excedente.

45. *Anabatidinæ.* Rostrum breviculum, validum, rectum, subemarginatum; membrana narium fornicata: digiti modici, fere disjuncti, medius longior quam laterales: remiges breves: cauda cuneata, rectricibus, rachide non excedente, rigidis.

46. *Sittinæ.* Rostrum rectum, seu adscendens, conicum, acutum; membrana narium plumata seu tecta; lingua lacera: digitus posticus medio æquilongus: alæ longæ, acutæ, remige prima vix secunda breviore: cauda mollis, brevissima.

20. PARIDÆ. Rostrum breve, conico-subulatum, durissimum, integerrimum; mandibula marginibus simplicibus, haud inflexis: nares plumulis densis, setaceis, tectæ, membrana obsoleta: pedes validi; digiti subfissi, internus omnium brevissimus: ungues validi, valde incurvi; posticus maximus.

47. *Parinæ.* Alæ breviculæ, rotundatæ, remigibus tribus primis gradatis.

21. TANAGRIDÆ. Rostrum breviculum, crassiculum, conico-trigonum, maxillis æqualibus, superior apice utrinque emarginato, subdeflexo, inferior marginibus simplicibus haud inflexis: nares nudæ, membrana fere obsoleta, carina interjecta: vibrissæ parvæ, adpressæ: pedes mediocres.

48. *Piprinæ.* Rostrum brevissimum, sub oculos usque fere fissum; maxilla valde incurva: pedes elongati, graciles; digitus externus longior quam internus, articulis tribus cum mediano concretus: alæ mediocres: cauda brevis, rectricibus duobus mediis quandoque elongatis.

49. *Tanagrinæ.* Rostrum mediocre, validum, modice fissum; maxilla parum incurva: pedes breves; digiti subliberi; pollex digitique laterales æquilongi, articulum secundum digiti medii vix superantes: ungues lati, incurvi: alæ caudaque longiculæ.

22. Alaudidæ. Rostrum conico-attenuatum, minime emarginatum, mandibula marginibus simplicibus, haud inflexis: nares membrana fornicata nudæ: pedes mediocres, digitis tenuibus, subliberis: ungues vix curvati, posticus digito prælongior.

50. *Alaudinæ.* Alæ remigibus tertiariis elongatis, secundariis apice emarginatis.

23. Motacillidæ. Rostrum longiculum, rectum, subulatum, utrinque emarginatum; mandibula marginibus simplicibus, haud inflexis: pedes longiculi, digitis tenuibus, exteriore cum mediano basi concreto, postico omnium valde longiore.

51. *Motacillinæ.* Alæ acuminatæ remigibus tertiariis elongatis, secundariis apice emarginatis: cauda producta, angusta.

24. Turdidæ. Rostrum subcultratum, utrinque emarginatum, mandibula marginibus simplicibus, haud inflexis: nares nudæ, membrana cartilaginea fornicata: pedes digitis lateralibus subliberis, inæqualibus, interno vix excedente articulum secundum medii: ungues inæquales: pennæ cubiti æquales.

52. *Cinclinæ.* Rostrum mediocre, rectum, depressiculum, vix emarginatum, gonyde adscendente, marginibus contractis: nares lineares: pedes robusticuli; digiti laterales æquilongi; squamæ tarsi integræ, lævigatæ: alæ breviculæ, rotundatæ: cauda brevissima, truncata.

53. *Myiotherinæ.* Rostrum rectum, subcylindraceum, apice abrupte inflexo: pedes elongati; digiti laterales subæquilongi, internus usque a basi separatus, divergens: alæ breves, rotundatæ, fornicatæ, remigibus brevissimis tectis: cauda brevis.

54. *Ixodinæ.* Rostrum distincte emarginatum; pedes brevissimi, digito

postico tarso subæquilongo: ungues breves, lati, valde incurvi: alæ breves, rotundatæ: uropygii plumæ elongatæ, confertissimæ.

55. *Turdinæ.* Rostrum emarginatum, culmine gradatim incurvo, sutura curvata: pedes mediocres: alæ longiculæ, acuticulæ.

56. *Timalinæ.* Rostrum rectum, compressum, durum, vix emarginatum: pedes grandes, validi; digitus internus usque a basi separatus, divergens: ungues parum incurvi: alæ breves, rotundatæ, remigibus brevissimis, tectis: cauda magna, lata, gradata, mollissima: plumæ omnes laxæ.

57. *Oriolinæ.* Rostrum longitudine capitis, latum ad basim, validum, compressum; rictus ampliculus; vibrissis nullis: pedes breves; digiti laterales inæquales: alæ elongatæ: plumæ uropygii confertæ.

58. *Leiothricinæ.* Rostrum robustum, gonyde adscendente: pedes grandes, robusti; digiti externi ad medium usque conjuncti, posticus exteriore longior: alæ breves, rotundatæ.

59. *Vireoninæ.* Rostrum robusticulum, compressum; maxilla utrinque emarginata, apice inflexo; mandibula apice adscendente: vibrissæ rigidulæ nares tegentes: pedes robusticuli; digito interno omnium brevissimo: alæ longiculæ, subacutæ: cauda mediocris, vel truncata vel emarginato-rotundata.

60. *Calamoherpinæ.* Rostrum subulatum, usque a basi compressum, emarginatum; mandibula tenuior maxilla: pedes validiculi, elongati: alæ breviculæ, subrotundatæ, remigum spuria minima extante, prima et secunda omnium longissimæ.

61. *Sylvinæ.* Rostrum gracillimum, subulatum, usque a basi compressum, emarginatum; mandibula tenuior maxilla: pedes graciles, longiculi: alæ longiculæ, acuticulæ, remigum spuria laticula extante, secunda et tertia omnium longissimæ.

62. *Saxicolinæ.* Rostrum ad basim depressum, sutura recta; vibrissis divergentibus: caput grandiculum: pedes longiculi: alæ elongatæ, ampliculæ: cauda brevicula, laticula.

63. *Sylvicolinæ.* Rostrum compressum, trigono-subulatum, vix emarginatum: pedes graciles; digiti laterales inæquales, pollex validiculus: alæ longiculæ, acuticulæ, remigum spuria nulla, tribus primis subæqualibus omnium longissimis.

25. Muscicapidæ. Rostrum usque a basi valde depressum, latum, maxilla marginibus mandibulam subtus late convexam amplectens, apice emarginato abrupte inflexa; rictus ampliculus, vibrissis porrectis; membrana narium obsoleta vel nulla: pedes breviculi, tenuiculi; digiti laterales articulos duos medii excedentes: ungues inæquales parum curvati.

64. *Muscicapinæ.* Rostrum mediocre, rectum, plus minus depressum, medio carinatum; rictus vibrissis rigidis elongatis: pedes breves, gracillimi: digiti laterales inæquales, exterior cum mediano conjunctus: alæ longiculæ: cauda elongata.

65. *Tæniopterinæ.* Rostrum longiculum, parum depressum, rotundiculum, lateribus rectis; gnathidiis verticaliter positis: pedes elongati, validiculi: alæ remige prima modice elongata: cauda longicula.

66. *Tyranninæ.* Rostrum usque a basi depressum; gnathidiis subhorizontaliter positis; rictus vibrissis nares obtegentibus: pedes breves, graciliculi; digiti laterales subæquilongi; ungues elongati, graciles, incurvi, acutissimi.

67. *Edolinæ.* Rostrum ultra medium compressum, culmine sensim curvato: pedes breves: alæ elongatæ, plus minus acutæ: cauda elongata, sæpius forficata.

68. *Ceblepyrinæ.* Rostrum ad basim latum, gnathidiis subhorizontalibus, angulo frontali acuto, sutura arcuata, vibrissis vix ullis: nares rotundatæ absque membrana, plumulis tectæ: pedes breves; digiti laterales inæquales: alæ elongatæ, remigibus tribus primis gradatis: cauda medio emarginata; hinc inde rotundata: plumæ uropygii densissimæ, fere spinosæ.

26. Lanidæ. Rostrum validiculum, convexum, compressum, apice deflexo utrinque, vel cum dente exserto, vel profunde emarginato, gnathidiis altis, verticalibus; sutura recta; vibrissæ, nares rotundatæ absque membrana: pedes mediocres; pollex graciliculus; ungues acuti: alæ mediocres, remige tertia seu quarta longiore.

69. *Psaridinæ.* Rostrum grandiculum, crassum, subcylindraceum, sinu rotundo frontem late intrans, apice abrupte inflexo emarginatum; nares rotundatæ, nudæ, parvæ: pedes exiles; digiti laterales in-

æquales; squamæ tarsi anteriores transversæ, laterales parvæ, numerosæ: alæ longæ.

70. *Tamnophilinæ*. Rostrum elongatum, strictum; sutura recta, apice abrupte inflexo, dente utrinque acuto: digiti laterales inæquales: exterior et medianus articulo primo conjuncti: ungues lati, obtusiculi: alæ breves, rotundatæ, fornicatæ, remigibus primariis decem pennas cubiti vix superantibus, brevissimis: cauda mediocris, rotundata.

71. *Laninæ*. Rostrum breviculum, dente utrinque acuto: digiti laterales æquilongi, liberi: ungues graciles, acuti: alæ mediocres.

27. Corvidæ. Rostrum robustum, vel conico-acuminatum, vel cultratum, frontem intrans cum basi: nares vel plumis setaceis recumbentibus, vel vibrissis tectæ: pedes validi.

72. *Garrulinæ*. Rostrum apice leviter deflexo, utrinque emarginato: nares rotundatæ absque membrana: pedes digitis lateralibus inæqualibus: alæ breviculæ, subrotundæ: formæ elegantes: plumæ nitide coloratæ.

73. *Corvinæ*. Rostrum ad basim cute crassa obvolutum, vix emarginatum; nares plumulis setiformibus densis contectæ, sutura recta: gnathidia valida, linearia, recta: pedes robusti, scutis prominulis; digiti subliberi, laterales subæquilongi: alæ longæ, acutæ: formæ graves: plumæ plus minus atratæ.

74. *Baritinæ*. Rostrum longitudine capitis, robustum, rectum, conico-compressum, apice parum subadunco, utrinque profunde emarginato, ad basim superne latum, circulariter frontem intrans; nares parvæ, nudæ, lineares, absque membrana; sutura recta: pedes magni, scutis lævibus; digiti subliberi, lateralibus subæquilongis, pollice maximo: alæ elongatæ.

75. *Glaucopinæ*. Rostrum breve, culmine elato, a basi gradatim curvatum, integerrimum; mandibula apice recto; sutura valde curva: rictus lævis: alæ breves, rotundæ: cauda elongata, gradata.

76. *Coracininæ*. Rostrum robustum, prædurum, rectum, compressum, ad basim depressum, culmine subcurvato tantum ad apicem, vix emarginatum; mandibula apice recto, depresso; rictus vibrissis raris: nares semiplumulosæ: pedes breves, validi; digitis anticis subæqualibus: alæ elongatæ: cauda brevis.

77. *Sturninæ.* Rostrum longulum, conico-acuminatum, integrum, utrinque angulatum ad basim, apice depressiculo, obtusiculo, subdeflexo; sutura ad basim deflexa; gnathidia alta, verticalia: nares nudæ: frons convexa: pedes scutati, digitis subliberis, lateralibus æquilongis, interno divergente, pollice maximo: remiges primariæ decem: plumæ capitis elongatæ, angustæ.

78. *Lamprotornithinæ.* Rostrum breviculum, compressum, utrinque angulatum ad basim, culmine a basi curvato, integrum: pedes digitis lateralibus inæqualibus: remiges primariæ novem: plumæ capitis elongatæ, angustæ.

79. *Quiscœlinæ.* Rostrum validum, a fronte recte depromptum, conico-elongatissimum, compressum, utrinque ad basim angulatum, culmine leviter curvato: pedes robusti: remiges primariæ novem: cauda gradata, navicularis: plumæ capitis rotundatæ.

80. *Icterinæ.* Rostrum a fronte recte depromptum, breviculum, conicum, utrinque ad basim angulatum, integrum aut rectum, aut mandibulis binis gradatim subincurvis: pedes validiculi, digitis lateralibus æquilongis: ungues crassi, valde curvati: remiges primariæ novem: plumæ capitis rotundatæ.

28. FRINGILLIDÆ. Rostrum breve, validum, conicum, crassissimum ad basim, mandibula marginibus validis curvatim intra se convergentibus, postice altioribus: pedes graciles.

81. *Ploceinæ.* Rostrum rectum, conicum, culmine depresso saltem posterius, angulo basilari lato, triangulari, frontem valde intrante: nares plano intervallo distantes: remiges primariæ decem, prima minuta.

82. *Emberizinæ.* Rostrum conicum, culmine recto, marginibus intractis, maxilla angustiore quam mandibula; tuberculo osseo longitudinali ad palatum: nares plano intervallo distantes: pedes mediocres; ungues graciles, incurvi: remiges primariæ novem.

83. *Fringillinæ.* Rostrum plus minus robustum, perfecte conicum, culmine tereti, saltem posterius; angulo frontali brevi, acuto: mandibulis æqualibus, subincurvis ad apicem tantum, integris: nares plano intervallo distantes: remiges primariæ novem, prima deficiente.

84. *Loxinæ.* Rostrum brevissimum, crassum, integrum, supra infraque curvatum; maxilla longiore, culmine marginibusque incurvis: nares

plano intervallo distantes: alæ remigibus primariis novem, primis quatuor subæqualibus.

85. *Pytilinæ.* Rostrum breve, crassum, subtrigonum, utrinque subemarginatum: angulus frontalis angustus, acutus, valde intrans: nares approximatæ carina tantum interjecta: alæ remigibus primariis novem, primis quatuor subæqualibus.

86. *Phytotominæ.* Rostrum breve, marginibus serratis; maxilla profunda, culmine arcuato: mandibula tenuis: nares plano intervallo distantes: pedes breves, validi, digitis duobus vel tribus anticis, uno postico: remiges primariæ novem.

29. Colidæ. Rostrum breve, integrum; maxilla ad basim dilatata, convexissima, culmine elevato, arcuato: pedes robusti: digiti fissi, omnes antrorsum versi!

87. *Colinæ.* Nares nudæ: alæ breves, acutæ: cauda longa, cuneata: plumæ mollissimæ.

30. Buceronthidæ. Rostrum enorme, inane, variatim appendiculatum, valde compressum, mandibula utraque incurva, marginibus integris: pedes magni, digitis externis ultra medium concretis.

88. *Bucerontinæ.* Digiti laterales inæquales; medius longitudine tarsi; pollex omnium brevissimus: alæ breviculæ, rotundatæ: cauda longicula, rectricibus rotundatis, ad basim angustis.

** *Tribus* II. *Scansores.* Digiti bini antici, binique postici.

31. Ramphastididæ. Rostrum immane, vacuum, marginibus serratis: digiti externi internis longiores, bini antici non ultra medium fissi: alæ breves, rotundatæ, tectricibus magnis.

89. *Ramphastidinæ.* Lingua penniformis: scuta tarsi sex: alæ breves, rotundatæ.

32. Picidæ. Rostrum rectum, polyedrum, apice cuneato: lingua lumbriciformis: digiti antici ad basim connati: tectrices alarum breves.

90. *Picinæ.* Rectrices rigidæ, acuminatæ.

91. *Yunginæ.* Rectrices molles, rotundatæ.

33. Bucconidæ. Rostrum rectum, conico-compressum, robustum, ad basim crassum, setis elongatis circumsessum: pedes grandiculi: digiti ex-

terni internis longiores, antici toto articulo primo connati, exterior posticorum versatilis, liber.

92. *Bucconinæ.* Alæ breves: cauda brevis, mollis: ungues omnes incurvi.

34. Cuculidæ. Rostrum tenue, setis vix ullis; lingua plana: tarsi scutati: digiti antici fere fissi, exterior posticorum versatilis, liber.

93. *Cuculinæ.* Rostrum tenue, convexum; nares rotundæ, margine prominente: pedes parvi: tarsus brevissimus, scutis quinque: digiti subtus molles, incrassati: alæ acutæ.

94. *Coccyzinæ.* Rostrum incurvum, marginibus maxillaribus dilatatis: nares lineares, simplices: pedes grandiculi; tarsus elongatus, nudus; digiti ad medium teretes: alæ breves, rotundatæ: cauda longissima cuneata.

95. *Crotophaginæ.* Rostrum latum, compressum, culmine elevato: nares simplices: pedes grandiculi, digitis ad medium teretibus.

96. *Saurotherinæ.* Rostrum elongatum, culmine convexo: nares simplices: pedes grandiculi, digitis ad medium teretibus.

97. *Indicatorinæ.* Rostrum breve, subconicum: nares simplices: pedes brevissimi.

35. Capitonidæ. Rostrum rectum, compressum, rictu amplo, setis elongatis circumsessum: pedes debiles.

98. *Capitoninæ.* Alæ rotundatæ.

36. Galbulidæ. Rostrum elongatum, rectum, quadrangulare, integerrimum; rictu amplo, vibrissis validis: pedes debiles; digiti externi internis longiores, bini antici ad apicem tantum discreti, interior posticorum brevissimus vel nullus.

99. *Galbulinæ.* Alæ breves: cauda elongata, gradata.

37. Trogonidæ. Rostrum breve, validum, triangulare, convexum, apice utrinque emarginato, rictu amplo: digitus secundus simul cum pollice retroversus! tertius et quartus antrorsum versi, concreti ad basim, interni externis longiores.

100. *Trogoninæ.* Pedes parvi, semihirsuti: alæ brevissimæ.

38. Musophagidæ. Rostrum breve, compressiculum versus apicem, maxilla profunda, culmine arcuato, marginibus serrulatis, mandibula tenui:

pedes breves, vix scansorii, digitis anticis tribus membrana connexis, externo subversatili, pollice omnium minimo: alæ breviculæ.

101. *Musophaginæ.* Cauda longa, rotundata, rectricibus latis decem.

Ordo 4. COLUMBÆ.

39. Columbidæ. Rostrum breve, tenue, debile, fornicatum; cuticula mollis, tumida, naribus imposita: pedes breves; digiti subtus molles, subincrassati; plumæ corporis densæ, rachide ad medium crassiore: plumæ uropygii rigidulæ.

102. *Columbinæ.* Digiti omnino fissi, parum divergentes: pedes parvuli, pollice insistente; tarsi scutati: alæ longiculæ.

103. *Ptilophyrinæ.* Digiti plica cutis ad basim juncti, valde divergentes: pedes validiculi, pollice subelevato; tarsi reticulati: alæ breves: cauda longa.

Subclassis 2. GRALLATORES.

Ordo 5. GALLINÆ.

40. Pteroclidæ. Rostrum tenue: alæ longæ, acutæ: cauda subelongata, acuta.

104. *Syrrhaptinæ.* Digiti tres coadunati, solo apice distincti.

105. *Pteroclinæ.* Digiti quatuor, anterioribus membrana connexis ad basim.

41. Penelopidæ. Rostrum validum, durum: digiti a basi divergentes, membrana connexi; ungues magni, compressi, acuti; pollicis insistens major: alæ breves: cauda elongata.

106. *Penelopinæ.* Pedes elongati, crassi.

42. Phasianidæ. Rostrum subvalidum, præ naribus excisum: digiti antici membrana connexi ad basim; pollex longiculus: alæ breves, rotundatæ: cauda producta.

107. *Pavoninæ.* Cauda in flabellum explicabilis, tectricibus productissimis.

108. *Phasianinæ.* Cauda compressa, inexplicabilis.

43. Tetraonidæ. Rostrum validum, continuo convexum, durum: digiti an-

tici membrana connexi ad basim: alæ breves, rotundatæ: cauda brevissima.

109. *Perdicinæ.* Nares nudæ: tarsi implumes: cauda perbrevis.

110. *Tetraoninæ.* Nares plumulosæ: supercilia glabra: tarsi plumosi: cauda longicula.

44. Crypturidæ. Rostrum tenue: digiti fissi: alæ breves, rotundatæ: cauda aut perbrevis aut nulla.

111. *Ortigydinæ.* Rostrum compressum: digiti tres, pollice nullo.

112. *Crypturinæ.* Rostrum depressum: digiti quatuor, pollice parvo.

Ordo 6. STRUTHIONES.

45. Struthionidæ. Digiti fissi duo tantum vel tres: tarsi scutulati: alæ breves, abortivæ, remigibus nullis.

113. *Struthioninæ.* Rostrum breve, crassum, gallinaceum: pedes ecalcarati.

114. *Apteryginæ.* Rostrum elongatum, gracile, grallaceum: pedes calcarati.

Ordo 7. GRALLÆ.

46. Charadridæ. Rostrum mediocre, validiculum: pollex nullus aut brevissimus.

115. *Otidinæ.* Rostrum breve, subfornicatum: pedes validi, reticulati, digitis tribus, anticis, brevibus, membranula connexis: ungues fornicati nec solidi: alæ breves, amplæ, remige tertia omnium longissima.

116. *Charadrinæ.* Rostrum breve, molle juxta basim, apice incrassato; sulcus nasalis profundus, ad medium rostrum extensus: pedes invalidi; digiti tres antici cylindracei; posticus fere semper nullus: alæ longæ, acutæ, remigum prima omnium longissima.

117. *Hæmatopodinæ.* Rostrum rectum, robustum, valde compressum, acutum: pedes breviculi; digiti omnes membrana connexi; interior omnium brevissimus: alæ longæ: cauda brevis.

47. Chionididæ. Rostrum breve, validum, compressum, integrum: pollex brevissimus, introversus.

118. *Chionidinæ.* Rostrum tectum ad basim vagina cornea, antice libera;

nares tubulares: pedes brevissimi, validi: squamæ tarsi parvulæ, scabræ: digiti exteriores membranula ad basim connexi, internus fissus: ungues fere detriti.

119. *Thynochorinæ.* Rostrum crasse, conicum: digiti mediocres: alæ acutæ, falcatæ.

48. Psophidæ. Rostrum breve, subfornicatum: digiti antici membrana conjuncti; pollex satis excultus.

120. *Palamedeinæ.* Pedes validi, crassi, reticulati; digiti longissimi: pollex robustus, fere totus insistens: alæ amplæ, bicalcaratæ.

121. *Gruinæ.* Pedes longi, graciles, scutati; digiti mediocres: pollex minutus, vix solo apice insistens: alæ amplæ, breves, concavæ.

49. Ardeidæ. Rostrum longum, validum: pollex longus, pluribus articulis solo incumbens: alæ magnæ.

122. *Ciconinæ.* Rostrum crassum, conico-elongatum, vix ante oculos fissum, rectissimum, culmine juxta medium depresso; maxilla lævi: caput plus minus implume: unguis medius integer; pollex a solo elevatus.

123. *Ardeinæ.* Rostrum longum, rectissimum, conico-elongatum, compressum, sub oculos usque fissum; maxilla utrinque longe sulcata: unguis medius serratus.

124. *Cancrominæ.* Rostrum breve, enormiter latissimum, naviculare; maxilla inanis secantes mandibulæ margines operiens.

125. *Plataleinæ.* Rostrum longum, planum, apice valde dilatato, rotundato: pedes semipalmati.

50. Tantalidæ. Rostrum prælongum, arcuatum: facies implumis: pollex longus, solo fere totus incumbens.

126. *Tantalinæ.* Rostrum apice obtuso rotundato, marginibus contractis secantibus: pedes elongati, digitis anticis membrana conjunctis.

51. Scolopacidæ. Rostrum elongatum, gracile, molliculum; sulco nasali fere ad apicem rostri continuato; rictus minimus: pollex brevis, gracilis, vix insistens aut nullus: alæ longæ, acutæ: cauda brevis.

127. *Tringinæ.* Rostrum vel longissimum vel breviculum, apice lævigato, haud crassiculo: digitus medius tarso brevior; pollex brevissimus aut nullus.

128. *Scolopacinæ.* Rostrum longissimum, rectum, apice ruguloso-scabro, in maxilla longiore subtus crassiculo: digitus medius tarso valde longior: pollex satis excultus.

52. Rallidæ. Rostrum breve, vel mediocre, crassiculum, compressum: pedes magni, crassi; digitis fissis longissimis; pollex longulus articulo primo insistens: alæ breves, rotundatæ: cauda brevissima, a tectricibus abscondita. *Corpus compressissimum: habitus gallinarum.*

129. *Parrinæ.* Rostrum rectum: pedes longissimi, digitis gracilibus et unguibus prælongis: alæ sæpius spinosæ.

130. *Rallinæ.* Rostrum subcurvatum: pedes mediocres, digitis crassiculis, unguibus congruis: alæ inermes.

53. Phalaropodidæ. Rostrum mediocre, rectum, gracile, flexile: pedes breves; tarsi compressi; digiti lobati.

131. *Phalaropodinæ.* Maxilla utrinque sulcata, apice deflexo, acuto.

54. Recurvirostridæ. Rostrum rectum, aut etiam recurvum, tenuissimum, flexile: pedes longissimi, debiles; tarsi compressiculi; digiti semipalmati.

132. *Recurvirostrinæ.* Rostrum teres, acuminatum.

55. Phœnicopteridæ. Rostrum breve, crassum, medio infractum, marginibus lamelloso-denticulatis: pedes longissimi, palmati.

133. *Phœnicopterinæ.* Maxilla intus solida, carinata, depressissima, valde exilior quam mandibula.

Ordo 8. ANSERES.

56. Anatidæ. Pollex parvus, liber: rostrum cute molli tectum, ungulatum ad apicem, depressum, marginibus lamelloso-denticulatis: lingua crassa, carnosa, lateribus dentatis.

134. *Cygninæ.* Rostrum basi tumidum, corneum, ad oculos usque implume, denticulis lamellosis compressis: collum longissimum: pedes breves, lati; pollex simplex.

135. *Anserinæ.* Rostrum breviculum, ad basim profundum, corneum, plumosum, denticulis abbreviatis, conicis, acutis: nares ad medium rostri: pedes longiculi, fere æquilibres; pollex simplex.

136. *Anatinæ.* Rostrum longiculum, latum, denticulis lamellosis elon-

gatis, compressis: collum breviculum: pedes brevissimi: pollex simplex.

137. *Fuligulinæ.* Rostrum mediocre, latum, denticulis lamellosis, elongatis, compressis: nares ad basim rostri: collum breviculum: pedes excentrici; pollex dilatatissimus, lobatus.

138. *Merginæ.* Rostrum elongatum, angustum, apice abrupte inflexo, rotundato, marginibus acute serratis: pedes breves, postice excentrici; pollex dilatatissimus, lobatus.

57. Pelecanidæ. Pollex elongatus, subinsistens, membrana junctus (digitis quatuor, omnibus membrana lata connexis), vel lobatus: pedes brevissimi: alæ magnæ, valde elongatæ. *In arboribus considunt.*

139. *Pelecaninæ.* Maxilla cæmentaria.

140. *Plotinæ.* Mandibula utraque solida.

58. Laridæ. Pollex liber, elevatus, vel nullus: pedes æquilibres: rostrum marginibus haud denticulatis; nares non protuberantes: alæ elongatæ, acutæ. *Bene ambulant: eximie volant: male urinantur.*

141. *Rhinchopinæ.* Rostrum mirifice compressum, maxilla valde brevior quam mandibula.

142. *Sterninæ.* Rostrum longum, compressum, apice recto acuminato: pedes breves: alæ valde elongatæ: cauda longissima, forficata.

143. *Larinæ.* Rostrum mediocre, compressum, apice valde incurvo; mandibula subtus conspicue angulata: pedes modici; tarsus digito medio sublongior; pollex brevissimus: alæ longissimæ: cauda breviculа, subtruncata.

144. *Lestrinæ.* Rostrum mediocre, ad basim rectum, cylindraceum, cera tectum, apice uncinato; maxillis cæmentariis; mandibula subtus angulata; pedes graciles; ungues validi, curvati: cauda gradata, rectricibus duabus mediis productis.

59. Procellaridæ. Pollex vel nullus, vel tantum unguis; pedes excentrici: rostrum marginibus haud denticulatis: nares tubulares: alæ elongatæ, acutæ. *Ire nesciunt: eximie volant: male urinantur.*

145. *Procellarinæ.* Rostrum rectum, apice abrupte uncinatum, maxillis cæmentariis.

60. Colymbidæ. Pollex parvus, liber: rostrum conico-subulatum, margini-

bus haud denticulatis: collum elongatum: tarsi compressissimi: alæ breves, minutæ, falcatæ, subacutæ. *Lacustres et marinæ. Incessus difficillimus, corpore erecto: volatus rectus, celer: urinatrices eximiæ.*

146. *Podicipinæ.* Rostrum subconicum: pedes lobati: cauda nulla.

147. *Colymbinæ.* Rostrum longulum, rectum, acutum: pedes palmati: cauda brevis.

61. Alcidæ. Pollex nullus: rostrum compressum, culmine plus minus arcuato, marginibus haud denticulatis: collum breve: tarsi parum compressi: alæ breves, minutæ, falcatæ, subacutæ. *Maritimæ. Boreales. Incessus difficillimus, corpore erecto: volatus rectus, celer: urinatrices eximiæ.*

148. *Phaleridinæ.* Nares nudæ: pedes palmati.

149. *Alcinæ.* Nares plumulis obtectæ: pedes palmati.

62. Spheniscidæ. Pollex grandiculus, liber, anteversus: cauda remigesque nullæ.

150. *Spheniscinæ.* Rostrum longum, tenue, mandibula sub basi incrassata: plumæ omnes squamiformes: alæ pinniformes. *Oceano Antarctico propriæ.*

Classis III. AMPHIBIA.

Animalia vertebrata, sanguine frigido, circulatione duplici, imperfecta, ovipara aut ovovivipara: pulmones bini vel unus, liberi: cor biloculare vel uniloculare, biauritum: dentes fere in omnibus: corpus vel cataphractum, vel squamosum, vel nudum.

Ordinum Distributio.

Subclassis 1. MONOPNOA (*Ablopnoa*).

Respiratio ope pulmonum tantum: metamorphosis nulla: corpus plus minus vestitum: condylus occipitalis simplex: penis: copulatio insita: ova crustacea aut coriacea.

Sectio 1. RHIZODONTA (*Loricata*).

Dentes infixi (maxillarum alveolis injuncti): labia libera nulla: lingua adnata: os tympanicum cum cranio concretum: costæ distinctæ: artus quatuor: penis simplex: anus longitudinalis.

1. Ornithosauri (*Gryphi*). Pedes tetradactyli; antici digito quarto enormiter elongato (membranam alarem expansam ad sustinendam idoneo). *Fossiles. Aerei.*
2. Emydosauri (*Crocodili*). Pedes digitati, antici pentadactyli, postici tetradactyli, palmati vel semipalmati. *Fluviatiles.*
3. Enaliosauri (*Cetosauri*). Pedes breves, pinniformes (permultis ossiculis conflati ut in Cete). *Fossiles. Marini.*

Sectio 2. TESTUDINATA.

Corpus clausum in theca bivalvi, supra a costis concretis constituta, infra a sterno: os tympani cum cranio connatum: dentes nulli: lingua adnata: penis simplex: artus quatuor.

4. Chelonii (*Testudines*). Corpus reversum, testeum.

Sectio 3. REPTILIA (*Squamata*).

Corpus squamosum: costæ distinctæ, truncum fere totum complectentes: cranium suturatum: dentes in maxillis non inserti: lingua libera: labia adpressa, margine libera: penis duplex: anus transversus.

5. Sauri (*Lacertæ*). Rictus haud dilatabilis: mandibulæ rami ad apicem per symphysim juncti: os tympani mobile: ossa faciei concreta, immobilia: oculi patentes: artus quatuor quandoque abortivi: sternum breve: claviculæ: pulmones duo.
6. Ophidii (*Serpentes*). Rictus dilatabilis: mandibulæ rami ad apicem ligamentis connexi: os tympani saltem mobile: oculi patentes: pedes, claviculæ, sternum, pelvis, tertia palpebra, tympanum nulli: pulmo alter abortivus vel nullus: lingua angustissima, bipartita, vibratilis, basi vaginata: corpus prælongum, teres.
7. Saurophidii (*Angues*). Rictus haud dilatabilis: mandibulæ rami ad apicem per symphysim juncti: os tympani cum cranio connatum, oblique

pronum: oculi parvi, sub cute latentes: tympanum nullum: corpus squamarum rudimentis annulatim cavatum: artus plerumque vel duo vel nulli: pulmo unicus, altero abortivo: lingua lanceolata, depressa, bifida, non vaginata.

Subclassis 2. DIPNOA (*Diplopnoa*).

Respiratio ope pulmonum simulque branchiarum in prima saltem vitæ periodo: metamorphosis in pleris: corpus, vix paucissimis exceptis, nudum: condylus occipitalis duplex: penis nullus: copulatio vel ex contactu tantum vel nulla: ova membranacea.

Sectio 4. BATRACHIA (*Nuda*).

Costæ imperfectæ: lingua carnosa, adnata.

8. Batrachophidii (*Cæciliæ*). Metamorphosi vix obnoxia: branchiæ evanidæ: os tympani cum cranio connatum: corpus apodum, ecaudatum: anus terminalis, rotundus.

9. Ranæ (*Batrachia vera*). Metamorphosi obnoxia: branchiæ (in larvis tantum operculatæ) deciduæ: pedes quatuor.

10. Ichthyodi (*Ichthyoidea*). Metamorphosi non obnoxia: branchiæ persistentes: anus longitudinalis: pedes quatuor vel duo.

Conspectus Familiarum et Subfamiliarum.

Subclassis 1. MONOPNOA.

Sectio 1. RHIZODONTA.

Ordo 1. ORNITHOSAURI.

1. Pterodactylidæ. Caput rostratum: collum elongatum vertebris septem longissimis: costæ tenues, elongatæ, simplices.
   1. *Pterodactylina*. Dentes æquales: orbitæ maximæ: cauda brevissima.

Ordo 2. EMYDOSAURI.

2. Crocodilidæ. Corpus loricatum; dorso transversim fasciato scutellis osseis durissimis: maxillæ sinuosæ.

2. *Crocodilina.* Dentes conici, inæquales: aures valvula obserabiles: cauda corpore longior, validissima, compressa, cristata.

3. *Teleosaurina.* Retro-nares maximæ, eodem plano ac fossa orbitalis sitæ.

Ordo 3. ENALIOSAURI.

3. PLESIOSAURIDÆ. Dentes alveolis distinctis inserti: vertebræ planiculæ.

4. *Plesiosaurina.* Caput minimum, rostratum, mandibula postice elongata; dentes numerosi: collum longissimum, vertebris numerosissimis: cauda brevis: pedes longiculi.

4. ICHTHYOSAURIDÆ. Dentes sulco communi inserti: vertebræ biconcavæ.

5. *Ichthyosaurina.* Caput magnum, orbitis maximis, acute rostratum: dentes numerosissimi (30—35 utrinque in utraque maxilla), æquales: costæ numerosæ, longiculæ, subtus conniventes: cauda longicula: pedes brevissimi, antici majores.

Sectio 2. TESTUDINATA.

Ordo 4. CHELONII.

5. CHELONIDÆ. Pedes natatorii, compressi, longitudine inæquales, digitis indistinctis: labia nulla.

6. *Chelonina.* Thorax scutis corneis tectus.

7. *Sphargidina.* Thorax corio verrucoso indutus.

6. TRIONYCIDÆ. Pedes ambulatorii, longitudine pares: thorax corio lævi indutus: labia carnosa.

8. *Tryonicina.* Pedes plantigradi, digitis distinctis, palmatis: os corneum: collum versatile: pelvis immobilis.

7. TESTUDINIDÆ. Pedes ambulatorii, longitudine pares: thorax scutis corneis tectus: labia nulla.

9. *Chelydina.* Pedes plantigradi, digitis distinctis, palmatis: os coriaceum: collum versatile: pelvis immobilis.

10. *Hydraspidina.* Pedes plantigradi, digitis distinctis, palmatis: os corneum: collum versatile: pelvis immobilis.

11. *Emydina.* Pedes plantigradi, digitis distinctis, plerumque palmatis: os corneum: collum retractile: pelvis mobilis.

12. *Testudinina.* Pedes digitigradi, clavati, digitis indistinctis: os corneum: collum retractile: pelvis mobilis.

Sectio 3. REPTILIA.

Ordo 5. SAURII.

8. Gekkonidæ. Lingua brevis, crassa, papillosa, apice obtuso vix emarginata: oculi grandes, palpebris brevissimis haud conniventibus, posteriore obsoleta; pupilla elliptica, verticali: os parietale duplex: corpus depressum.

13. *Gekkonina.* Dentes maxillarum lateri interno adnati: aures conspicuæ, membrana profundata: squamæ dorsi parvulæ, tuberculis permixtis: digiti liberi, subæquales. *Tarda: nocturna.*

9. Stellionidæ. Lingua brevis, crassa, papillosa, apice obtuso vix emarginata: oculi palpebris conniventibus clausiles, pupilla rotunda: os parietale simplex: corpus depressum, dorsi culmine subplano, plerumque non cristato.

14. *Agamina.* Dentes adnati (maxillarum latere interno affixi).

15. *Stellionina.* Dentes innati (maxillarum culmini connati).

10. Iguanidæ. Lingua brevis, crassa, papillosa, apice obtuso vix emarginata: oculi palpebris conniventibus, pupilla rotunda: os parietale simplex: corpus plus minus compressum, in dorsi culmine carinatum vel cristatum.

16. *Iguanina.* Dentes adnati, laniarii nulli.

17. *Draconina.* Dentes innati, laniarii distincti.

11. Chamæleontidæ. Lingua longa, carnosa, cylindracea, vibratilis, apice incrassato, integra, basi vaginata: gula dilatabilis: palpebræ circulares, foramine parvo, pupilla rotunda: corpus compressum.

18. *Chamæleontina.* Dentes cum maxillis concretis: aures latentes: os frontale simplex: squamæ graniformes: cauda prehendens: pedes pentadactyli, digitis in duos oppositos fasciculos coadunatis.

12. Varanidæ. Lingua longissima, lævis, angusta, vibratilis, longissime bifurca, basi vaginata: laminæ supraorbitales cutaceæ, ossiculo su-

perciliari accessorio: caput superne clypeolato-squamosum, pyramidale: corpus elongatum, depressiculum.

19. *Varanina.* Dentes adnati: os frontale duplex: cutis reticulatim exarata: pori femorales nulli: digiti liberi, inæquales.

13. Helodermatidæ. Lingua ......: laminæ supraorbitales cutaceæ: oculi palpebrati: aures conspicuæ; membrana tympani superficialis: caput tuberculato-squamosum, depressum: corpus elongatum.

20. *Helodermatina.* Dentes adnati: cutis sulculis exarata: squamæ tuberculiformes osseæ: pori femorales nulli.

14. Ameividæ. Lingua elongata, emissilis, squamuloso-papillosa, angusta, longissime bifurca: aures conspicuæ, membrana tympani superficialis: oculi palpebrati: laminæ supraorbitales omnino cutaceæ: caput pyramidale, regulariter scutellatum.

21. *Ameivina.* Dentes adnati, corona posteriorum denticulata.

22. *Podinemina.* Dentes innati, corona omnium simplex.

15. Lacertidæ. Lingua brevicula, squamuloso-papillosa, bicuspis: oculi palpebrati: laminæ supraorbitales subosseæ: squamæ difformes.

23. *Lacertina.* Dentes adnati: cutis flexilis: caput superne scutatum: cauda elongata, teres, verticillata: digiti simplices, subtus læves.

24. *Psammodromina.* Dentes adnati: cutis flexilis: caput superne scutatum: cauda elongata, teres, verticillata: digiti, vel ad latera serrati, vel subtus carinati.

16. Ophiosauridæ. Lingua brevis, squamuloso-papillosa, apice attenuato obtuso plus minus excisa: oculi non semper palpebrati: aures conspicuæ: squamæ fasciatim positæ, carinatæ: pedes in pluribus duo vel nulli!

25. *Chamæsaurina.* Dentes adnati: cutis rigida: squamæ angustæ, acutæ, in abdomine dorsoque æquales.

26. *Ophiosaurina.* Dentes adnati: cutis rigida: squamæ subquadratæ: plicatura lateralis.

17. Anguidæ. Lingua brevis, squamuloso-papillosa, apice attenuato obtuso plus minus excisa: oculi non semper palpebrati: squamæ uniformes, imbricatæ, lævigatæ: pedes in pluribus duo vel nulli!

27. *Scincina.* Dentes adnati: cutis rigida. Habitus lacertinus: pedes

quatuor, pentadactyli: aures conspicuæ; tympani membrana profundata.

28. *Anguina.* Dentes adnati: cutis rigida. Habitus serpentinus: corpus cylindraceum, gracile: cauda longissima: artus, vel quatuor brevissimi, remotissimi, vel posteriorum rudimenta tantum vel nulli!

18. Typhlopidæ. Lingua longa, bifurca: oculi vix ulli: squamæ uniformes, imbricatæ, lævigatæ: pedes nulli.

29. *Typhlopina.* Dentes adnati: cutis rigida. Habitus amphisbæninus: corpus longulum, cylindraceum, in utroque apice obtusum: cauda brevissima.

Ordo 6. OPHIDII.

19. Erycidæ. Dentes venenati nulli; omnes breves, conici: calcarium rudimenta ad anum vix conspicua; pedum nulla: caput a trunco non distinctum, parvum, obtusum, scutis parum conspicuis: os parvum: oculi exigui: nares angustæ: corpus exile, undique cylindraceum: cauda brevis, conica.

30. *Erycina.* Corpus graciliculum: squamæ exiguæ, subrotundæ, per series longitudinales dispositæ: abdomen et cauda subtus scutis simplicibus, hexagonis, transversis.

31. *Calamarina.* Corpus funiculiforme: squamæ prismaticæ, lævissimæ: abdomen et cauda subtus scutis parum numerosis.

20. Boidæ. Dentes venenati nulli: calcaria cornea ad anum: ossa interna pedum posticorum rudimentaria: corpus longissimum, medio incrassatum; cauda teres, prehendens: caput a trunco distinctum, crassum: oculi parvi, pupilla horizontali: nares fere superæ: scuta abdominis caudæque inexpleta: squamæ numerosæ.

32. *Boina.* Intermaxillare edentulum: orbitæ normales, ossibus frontalibus mediis superne marginatæ: scuta abdominalia.

33. *Pythonina.* Intermaxillare dentatum: orbitæ ab osse peculiari supranumerario perfectæ: scutella abdominalia.

21. Acrochordidæ. Dentes venenati nulli: calcaria nulla: corpus undique squamosum, compressum: cauda compressa, valde prehendens. *Aquatica.*

34. *Acrochordina.* Caput rotundatum: oculi exigui: nares superæ, ap-

proximatæ, tubulares: squamæ minimæ, non imbricatæ, mucronatæ: abdomen longitudinaliter squameo-carinatum.

22. Colubridæ. Dentes venenati nulli: anus appendicibus destitutus: caput scutis novem plerumque protectum: oculi naresque laterales: abdomen latissime scutatum: cauda teres.

35. *Colubrina.* Corpus fusiforme: caput latum: cauda modice elongata: squamæ in lineas longitudinales positæ. *Terrestria.*

36. *Dipsadina.* Corpus longissimum, gracillimum: caput latum: cauda valde elongata: squamæ in lineas longitudinales positæ. *Arborea.*

37. *Dendrophilina.* Corpus longissimum, gracillimum: caput longum: cauda valde elongata: squamæ in lineas transversas positæ. *Arborea.*

38. *Natricina.* Corpus breviculum, torosum; abdomine dilatato, convexo: caput latissimum, valde distinctum, conicum; rostro brevi, oris angulo elevato: cauda brevis: squamæ grandiculæ, carinatæ, in lineas longitudinales positæ. *Aquatica.*

23. Hydridæ. Solidi dentes, venenatique in maxilla: cauda compressissima, remiformis. *Marina.*

39. *Hydrina.* Caput parvum, indistinctum: oculi naresque valvulares superi: scutula ventralia.

24. Najidæ. Venenati dentes, solidis sæpius adjunctis, in maxilla: maxillare protractum: caput scutis tectum: oculi mediocres, pupilla rotunda: nares laterales, patulæ: corpus elongatum: cauda brevis, crassa, conica: squamæ grandes, rhomboideæ, plerumque læves.

40. *Bungarina.* Collum haud dilatabile: caput elongatum, parum distinctum: corpus undique cylindraceum: cauda robusta: squamæ latæ, læves, in lineas circiter sexdecim positæ.

41. *Najina.* Collum dilatabile: caput conicum, distinctum: corpus medio incrassatum: cauda elongata, conica: squamæ lanceolatæ, sæpius carinatæ.

25. Viperidæ. Maxilla venenatis tantum dentibus armata: maxillare contractum: caput valde distinctum, depressum, postice dilatatum, squamis plerumque tectum: rostro truncato ac sæpe etiam simo;

labium superum prolapsum; rictus arcuatus: oculi parvi, cavati, pupilla verticali: corpus abbreviatum, crassum: cauda brevissima: squamæ lanceolatæ, carinatæ.

42. *Crotalina.* Foveæ præoculares binæ.

43. *Viperina.* Foveæ præoculares nullæ.

Ordo 7. SAUROPHIDII.

26. Chalcididæ. Pedes quatuor.

44. *Chalcidina.* Truncus utrinque sulcatus.

27. Cheirotidæ. Pedes duo, antici: sternum ossiculo scapulo-claviculari utrinque, sine furcula.

45. *Cheirotina.* Dentes maxillis adnati.

28. Amphisbænidæ. Nec pedes, nec apparatus sterno-scapularis.

46. *Amphisbœnina.* Dentes maxillis adnati.

47. *Trogonophina.* Dentes cum maxillis concreti.

Subclassis 2. DIPNOA.

Sectio 4. BATRACHIA.

Ordo 8. BATRACHOPIDII.

29. Cæcilidæ. Pedes nulli.

48. *Cæcilina.* Cranium non suturatum: lingua mento tota affixa.

Ordo 9. RANÆ.

30. Ranidæ. Ecaudata: corpus breve, latum: artus antici breviculi: sternum et claviculæ perfectæ: costæ nullæ: anus rotundatus. *Larva apoda, caudata, et corneo-rostrata: herbivora.*

49. *Pipina.* Lingua sub cute abscondita: una tantum apertura pro tubis eustachianis.

50. *Ranina.* Lingua conspicua: tubæ eustachianæ distinctæ: dentes maxillares: apices digitorum simplices.

51. *Hyladina.* Lingua conspicua: tubæ eustachianæ distinctæ: dentes maxillares: apices digitorum disciformes.

52. *Bufonina.* Lingua conspicua: tubæ eustachianæ distinctæ: dentes nulli.

31. Salamandridæ. Caudata: corpus elongatum, subteres: artus æquilongi: sternum et claviculæ nullæ: costæ: anus longitudinalis. *Larva tetrapoda.*

53. *Pleurodelidina.* Oculi congrui, palpebrati: appendix cutanea trunci nulla: cauda teres: costæ veræ.

54. *Salamandrina.* Oculi congrui, palpebrati; appendix cutanea trunci nulla: cauda aut teres, aut compressa: costæ veræ nullæ.

55. *Andriadina.* Oculi minimi, palpebris nullis; appendix cutanea trunci utrinque natatoria: cauda depressa.

Ordo 10. ICHTHYODEI.

32. Amphiumidæ. Branchiæ obsoletæ in respectiva cavitate latentes, foro externo utrinque laterali: cranium non suturatum.

56. *Protonopsidina.* Corpus granosum: rostrum productum: oculi minimi: cauda compressa: pedes quatuor, antici subpalmati.

57. *Amphiumina.* Corpus subteres: rostrum truncatum: oculi mediocres: cauda compressa: pedes quatuor, imbecilles.

33. Sirenidæ. Branchiæ conspicuæ, liberæ: cranium suturatum.

58. *Hypochtonina.* Pedes quatuor.

59. *Sirenina.* Pedes duo.

Classis IV. PISCES.

Animalia vertebrata sine pulmonibus, branchiis respirantia, sanguine frigido, rubro, ovipara vel ovovivipara, natantia: cor uniloculare, uniauritum: dentes fere in omnibus: corpus vel squamosum vel tuberculosum vel nudum: collum nullum: pinnæ loco artuum.

ORDINUM DISTRIBUTIO*.

Subclassis 1. ELASMOBRANCHII.

Branchiæ fixæ, haud operculatæ, lamellares, radiis verticalibus paucis rarisque superextensam membranam mucoso-vascularem minute plicatam sustinentibus: cranium non suturatum. *Copula gaudent.*

Sectio 1. PLAGIOSTOMI.

Sceletum cartilagineum, granulosum: ossa maxillaria et intermaxillaria connata: cartilagines labiales in pluribus: dentes maxillis non infixi, sed cute tantum adjuncti, cum eaque nutantes: os transversum, latum: corpus aut tuberculatum aut nudum.

1. SELACHA. (*Chondropterygii.*) Branchiæ penitus fixæ: fissuris utrinque 5—7.

2. HOLOCEPHALA. (*Acanthorrhini*). Branchiæ partim tantum marginibus fixæ; foraminibus quinque interioribus in fundo fissuræ utrinque unicæ; operculo tantum abortivo, sub cute latente: maxilla cum cranio connata.

Subclassis 2. LOPHOBRANCHII.

Branchiæ liberæ, palmiformes, radio verticali uno palmato in singulis arcubus: operculum unicum magnum membrana undique obseratum, parvo tantum juxta nucham foramine relicto: cranium suturatum.

Sectio 2. SYNGNATHI.

Sceletum fibroso-osseum: maxillæ perfectæ, liberæ.

3. OSTEODERMI. (*Heteropteri.*) Corpus loricatum, angulosum.

* Etsi ordinatorias meas hasce elucubratiunculas non despiciam, in quibus naturalem universorum Piscium harmoniam magis studueram consectari, fallacesque inde vel a sceleti compagine vel a pinnarum radiorum sive molli sive rigida qualitate, vel a squamarum structura primarias definitiones desumptas magis magisque horruissem; non ideo tamen ubique quod penitius optaveram attigisse puto, rationemque, non inepte fortasse, repeto a reverentia mea veteri erga clarissimos in philosophia naturali viros, inter quos principaliorem cathedram sibi merito præripuit Cuvierus, quem honoris causa nomino. Re tamen vera, ne sensibiles naturæ affinitates interciderentur, *Labrides*, *Mugilides*, aliosque *Acanthopterygios*, *Cyprinis* addidi, *Ophidides* et *Murænides* a *Scombris* derivando. Ab Agassizianis denique, Cuvierianisque characteribus, quos ipse conserui discedendum magis forte erit quatenus Piscium ordines describi naturaliter velint.

Subclassis 3. POMATOBRANCHII.

Branchiæ liberæ, operculatæ, radiis verticalibus numerosis in formam pectinis compositis, horizontalique lamellularum duplici serie infra supraque pectinulatis: cranium suturatum.

Sectio 3. PLECTOGNATHI.

Sceletum fibroso-cartilagineum: maxillæ imperfectæ, non liberæ: opercula sub cute latentia; fissura branchialis utrinque parva.

4. SCLERODERMI. (*Acanthopteri.*) Dentes distincti.
5. GYMNODONTES. (*Pelvopteri.*) Rostrum corneum intrinsecus laminosum, loco et vice dentium.

Sectio 4. MICROGNATHI.

Sceletum cartilagineum, granulosum, processubus transversis osseis: vomer cum cartilaginibus frontalibus protractum: maxilla parva rudimentaria.

6. STURIONES. (*Acipenseres.*) Os labiis cœnosis exiguum, retractile.

Sectio 5. TELEOSTOMI.

Sceletum fibroso-osseum: maxillæ perfectæ, liberæ: corpus plerumque squamosum.

7. GANOIDEI. (*Siluri.*) Squamæ cortice vitreo, stratis infra lamellaribus, integris vel denticulatis subpositis.
8. CTENOIDEI. (*Percæ.*) Squamæ asperæ, margine postico ciliato, stratis lamellaribus denticulatis subpositis.
9. CYCLOIDEI. (*Cyprini.*) Squamæ læves, stratis lamellaribus integerrimis subpositis.

Subclassis 4. MARSIPOBRANCHII.

Branchiæ fixæ, haud operculatæ, bursiformes, radiis vix ullis, membrana mucoso-vasculari superextensa contectis: cranium non suturatum.

Sectio 6. CYCLOSTOMI.

Sceletum membranaceo-cartilagineum: maxillæ connatæ: dentes non infixi: corpus nudum.

10. HELMINTHOIDEI. (*Lampetræ.*) Os annulare, carnoso labio suctorio.

Conspectus Familiarum et Subfamiliarum.

Subclassis 1. ELASMOBRANCHII.

Sectio 1. PLAGIOSTOMI.

Ordo 1. SELACHA.

1. Rajidæ. Cartilago peculiaris interior a nasali parte cranii ad principium pinnæ pectoralis descendens: palpebræ adnatæ: corpus depressum, dilatatum, plerumque nudum, pinnis amplissimis pectoralibus inclusum: analis nulla: branchiarum fissuræ inferæ.

Rajidæ veri. Corpus in formam caudæ abrupte deficiens.

1. *Cephalopterini.* Caput truncatum, appendicibus utrinque foliaceis tanquam bicorne: pinnæ pectorales latissimæ, in longissimos apices productæ: cauda tenuissima, elongata, pinna dorsali et aculeo utrinque serrato munita: dentes minuti serratim positi.
2. *Myliobatini.* Caput ovatum, liberum a pinnis pectoralibus latissimis acuminatis: cauda tenuissima, elongata, pinna dorsali et valido aculeo utrinque serrato armata: dentes grandes, complanati, tessellati ad instar operis musivi.
3. *Anacanthini.* Caput pinnis pectoralibus amplis præcinctum: cauda tenuis, nec dorsali pinna nec aculeo munita: dentes minuti, tesselliformes, in quincuncem positi.
4. *Trygonini.* Caput pinnis pectoralibus amplis præcinctum: cauda tenuis aculeo valido utrinque serrato armata: dentes minuti, tesselliformes, in quincuncem positi.
5. *Rajini.* Corpus rhomboidale: caput pinnis pectoralibus amplis præcinctum: cauda tenuis, elongata, pinnis dorsalibus duabus: dentes exigui, numerosi, polymorphi, in quincuncem positi.

Rajidæ anomali. Corpus in formam caudæ gradatim deficiens.

6. *Torpedinini.* Corpus orbiculare, læve, caput pinnis pectoralibus amplis præcinctum: cauda crassa, ad basim depressa, mediocriter longa,

pinna apicali ingenti, triangulari: dentes minuti, acuti: apparatus electricus a capite inter branchias pinnasque pectorales.

7. *Rhinobatini.* Corpus rhomboidale elongatum, rostratum: cauda crassa carnosa: pinnæ dorsales duo, remotæ: caudalis apicalis: dentes minuti, tesselliformes, in quincuncem positi.

8. *Pristidini.* Corpus elongatum, antice depressum: rostrum longissimum, planum, osseum, utrinque spinatum: dentes granuliformes, in quincuncem positi.

2. Squalidæ. Cartilago peculiaris interior prorsus nulla: palpebræ liberæ: corpus elongatum, subteres, sæpius tuberculosum; tuberculis squamiformibus, minutis, plerumque integris, subovatis: pinnæ pectorales mediocres: branchiarum fissuræ laterales.

* *Squalidæ anomali.* Corpus depressum: pinnæ pectorales ampliculæ.

9. *Squatinini.* Spiracula: pinna analis nulla.

** *Squalidæ veri.* Corpus elongatum, teres: pinnæ pectorales congruæ.

10. *Spinacini.* Membrana nictitans nulla: spiracula: pinnæ dorsales antice aculeatæ; analis nulla: dentes compressi, secantes; mandibulares cultro horizontali, margine laterali interno integro, externo cuspidato: tuberculi squamiformes tricuspides.

11. *Scymnini.* Membrana nictitans nulla: spiracula: pinnæ dorsales inermes: analis nulla: dentes triangulares, maxillares lesiniformes, pluriseriales; mandibulares basi lata, uni- vel bi-seriales.

12. *Notidanini.* Fissuræ branchiarum utrinque ultra quinque! membrana nictitans nulla: spiracula minima: pinna dorsalis unica; analis: dentes mandibulares compressi, latissimi, pectiniformes; maxillares falciformes, apicibus ad angulum oris reclinatis: tuberculi squamiformes tricuspides: lingua adnata!

13. *Triglochidini.* Membrana nictitans nulla: spiracula parva: branchiarum fissuræ maximæ, omnes ante pinnas pectorales sitæ: pinnæ grandiculæ; analis; caudalis lobo superiore elongato, superius minime excavata: dentes longi, acuti, utrinque denticulo uno vel bino.

14. *Lamnini.* Membrana nictitans nulla: spiracula exigua: branchiarum fissuræ maximæ, omnes ante pinnas pectorales sitæ: secunda dorsalis et analis parvæ, oppositæ; caudalis lunata, hinc inde carinata, superius excavata: dentes sæpius acuti: valvula intestinalis spiralis.

15. *Alopiadini.* Membrana nictitans nulla: spiracula minima: branchiarum fissuræ parvæ, ultima supra pectorales sita: dentes simplices.

16. *Squalini.* Membrana nictitans! spiracula nulla vel parva: fissuræ branchiarum ultima et sæpe etiam penultima supra pinnas pectorales sitæ: dorsalis secunda anali subopposita: dentes compressi, triangulares, acuti.

17. *Mustelini.* Membranæ nictitantis rudimentum: spiracula magna: pinnæ dorsales inermes; secunda anali opposita: dentes parvuli, obtusi, in quincuncem positi.

18. *Cestraciontini.* Membrana nictitans nulla: spiracula grandicula: fissuræ branchiarum parvæ, ultima supra pectorales sita: dorsales antice aculeatæ; analis: maxillæ exporrectæ: dentes in quincuncem positi, mediocres, parvi, acuti, laterales latissimi.

19. *Triænodontini.* Membrana nictitans: spiracula vel nulla vel mediocria: branchiarum fissura ultima, et sæpe etiam penultima, supra pinnas pectorales sitæ: secunda dorsalis anali opposita: dentes acuti, denticulis utrinque muniti.

20. *Scyllini.* Membrana nictitans nulla: spiracula amplicula: pinnæ dorsales ambæ ventralibus non antepositæ: dentes parvi, acuti, denticulo utrinque uno vel pluribus: tuberculi squamiformes tricuspides: valvula intestinalis spiralis. *Ovipari!*

Ordo 2. HOLOCEPHALA.

3. CHIMÆRIDÆ. Corpus læve, vel exiguis aculeis hispidum: dura loco dentium scuta, supra quatuor, infra duo.

21. *Chimærini.* Rostrum prominulum, antice foliaceum: pinnarum dorsalium prior valido aculeo armata.

Subclassis 2. LOPHOBRANCHII.

Sectio 2. SYNGNATHI.

Ordo 3. OSTEODERMI.

4. SYNGNATHIDÆ. Corpus scutatum.
    22. *Pegasini.* Os inferum ad basim rostri.
    23. *Syngnathini.* Os terminale in apice rostri.

Subclassis 3. POMATOBRANCHII.

Sectio 3. PLECTOGNATHI.

Ordo 4. SCLERODERMI.

5. BALISTIDIDÆ. Rostrum conicum, productum: os exiguum.
    24. *Balistidini.* Corpus compressum, squamis magnis durissimis rhomboidalibus tectum.
    25. *Ostraciontini.* Corpus polyedrum, cataphractum.

Ordo 5. GYMNODONTES.

6. TETRAODONTIDÆ. Corpus inflabile, plus minus spinosum.
    26. *Tetraodontini.* Maxilla utraque rostri bipartita, vel saltem superior, marginibus obtuse denticulatis: aculei corporis breves.
    27. *Diodontini.* Maxilla utraque rostri simplex, integra: aculei corporis longi.
7. ORTHAGORISCIDÆ. Corpus non inflabile, haud spinosum: sceletum fere omnino cartilagineum.
    28. *Orthagoriscini.* Corpus admodum compressum, postice truncatum, pinna caudali profunda, brevi: ventralibus nullis: anali valde retroposita.

Sectio 4. MICROGNATHI.

Ordo 6. STURIONES.

8. POLYODONTIDÆ. Corpus læve: dentes minuti, numerosi.
    29. *Polyodontini.* Rostrum longissimum, dilatato-foliaceum: opercula longissimo mucrone munita.

9. Acipenseridæ. Corpus scutatum: dentes nulli.

30. *Acipenserini.* Rostrum mediocriter longum, modice angustum: opercula inermia.

Sectio 5. TELEOSTOMI.

Ordo 7. GANOIDEI.

10. Loricaridæ. Corpus scutis osseis tectum: os inferum: opercula branchialia immobilia: ossa intermaxillaria parva, maxillaribus transversis haud contiguis: primus radius pinnarum dorsalis, pectoralium et ventralium validus, aculeatus; cæteri molles.

31. *Loricarini.* Pinna dorsalis unica, secunda quandoque exigua.

11. Siluridæ. Corpus nudum: ossa intermaxillaria maxima, marginem maxillæ constituentia, maxillaribus subabortivis, aut in cirros conversis: pinna dorsalis postica plerumque adiposa: radius primus dorsalis anticæ atque pectoralium passim aculeatus, articulatus, cæteri molles: pinnæ ventrales infra pectorales sitæ: os terminale: opercula branchialia mobilia.

32. *Callichtini.* Os parvum; dentes fere inconspicui: corporis nudi series laminarum quatuor ad latera: pinnæ dorsales duo, secunda radio unico.

33. *Pimelodini.* Os modicum; dentes forma et loco varii: latera vel inermia, vel una tantum laminarum serie: pinnæ dorsales duo, secunda adiposa.

34. *Silurini.* Os amplum; dentes numerosi: corpus omnino nudum: pinna dorsalis unica, exigua; analis longissima.

12. Lepidosteidæ. Corpus squamis lapideis: omnes pinnarum radii molles: pinnæ ventrales post pectorales ossibus pelvis non appensæ.

35. *Lepidosteini.* Rostrum intermaxillaribus, maxillaribus, palatinisque ossibus cum vomere atque ethmoideo connatis: membrana branchiostega triradiata: dorsalis pinna ac analis pariter et valde retropositæ: radii pinnarum primi squameo-serrati.

36. *Polypterini.* Maxilla margine immobili, intermaxillaribus mediis, maxillaribus lateralibus: membrana branchiostega uniradiata: pinnæ dorsales numerosæ, singulæ aculeo munitæ.

13. Tetragonuridæ. Corpus squamis grandibus, asperis, ciliatis, cuti adhærentissimis: dentes validiculi, acuti: pinnæ dorsales duo; antica radiis spinosis longa, humilis; ventrales paulo post pectorales.

37. *Tetragonurini.* Cauda utrinque cristata! labium inferius intus carinatum.

14. Macrouridæ. Squamæ duriter asperæ: os inferum! pinnæ ventrales infra gulam sitæ, acuminatæ: omnes pinnarum radii molles.

38. *Macrourini.* Corpus elongatum, tereticulum, postice compressum, attenuatum, antice rostratum: os inferum: pinnæ dorsales duo; postica elongata caudalem acuminatam cum anali conjunctam at tingens.

Ordo 8. CTENOIDEI.

15. Pleuronectidæ. Corpus eximie compressum: caput non symmetricum: oculi unilaterales: radii omnes pinnarum molles: pinnæ ventrales sub pectoralibus: pelvis ossibus humeralibus appensa.

39. *Soleini.* Maxilla longior mandibula: oculi parvi: nares unilaterales: præoperculum ab operculo non distinctum: pinnæ pectorales parvulæ aut nullæ: squamæ laminula pedunculatæ: linea lateralis recta.

40. *Pleuronectini.* Mandibula longior maxilla: oculi grandes: nares hinc inde binæ: laminæ operculares distinctæ: pinnæ pectorales congruæ: squamæ sessiles: linea lateralis antice arcuata.

16. Chætodontidæ. Corpus compressum: palatum edentulum: dorsalis pinna atque analis æque ac in trunco squamis magna saltem ex parte obtectæ, radiis spinosis pluribus; ventrales unico.

41. *Pimelepterini.* Dentes sectorii.

42. *Chætodontini.* Dentes setacei, conferti in utraque maxilla. *Colores admodum vivi.*

17. Anabantidæ. Cellulæ in pharyngeis ossibus superioribus ab eorum foliolis irregularibus dispertitæ! Radii pinnæ dorsalis et analis plures spinosi. *Diu extra aquam vivere valent.*

43. *Anabantini.* Corpus teres: caput latum, rostro brevi, obtuso: squamæ solidæ: linea lateralis interrupta.

18. Fistularidæ. Rostrum tubuliforme ore exiguo terminali: radii spinosi plures in prima saltem dorsali.
    44. *Caproidini.* Corpus subrotundum, compressum: rostro brevi.
    45. *Centriscini.* Corpus ovale, compressum: rostro longissimo.
    46. *Fistularini.* Corpus elongatum, cylindraceum: rostro longissimo.
19. Mœnidæ. Os valde protractile: palatum dentibus instructum, vel (præoperculo margine denticulato) edentulum: radii spinosi plures in pinna dorsali ac anali; unus in utraque ventrali.
    47. *Mœnini.* Pinna dorsalis non squamosa.
    48. *Cæsionini.* Pinna dorsalis squamosa.
20. Sparidæ. Laminæ operculares integræ, spinis carentes: os non protractile: palatum edentulum: squamæ grandes: pinna dorsalis squamis destituta, radiis spinosis pluribus ac in anali; ventrales unico.
    49. *Obladini.* Dentes sectorii, uniseriales; molares hemisphærici nulli.
    50. *Cantharini.* Dentes numerosi, conferti, tenuissimi.
    51. *Lethrinini.* Dentes interdum molares hemisphærici, uniseriales: genæ sine squamis.
    52. *Denticini.* Dentes omnes conici; nonnulli ex anterioribus producti, incurvi: genæ squamosæ.
    53. *Sparini.* Dentes molares hemisphærici: genæ squamosæ.
21. Chromididæ. Laminæ operculares integræ, spinis carentes: labia carnosa duplicata: dentes in maxillis nec non in tribus ossibus pharyngeis: squamæ grandes: pinna dorsalis unica, radiis filamentose appendiculatis, spinosis pluribus ac in anali; ventrales unico.
    54. *Chromidini.* Corpus oblongum: dentes maxillares et pharyngei tenuissimi, conferti, præposita conicorum majorum serie.
    55. *Cychlini.* Corpus elongatum: dentes omnes tenuissimi, conferti.
22. Sciænidæ. Laminæ operculares margine denticulatæ aut spinosæ: genæ non loricatæ: os protractile: vomer et ossa palatina dentibus destituta: pinnæ verticales sæpe squamosæ, radiis spinosis pluribus; ventrales unico.
    56. *Pomacentrini.* Cranium minime tumens, nec ossibus cavernosis constans: linea lateralis sub pinnæ dorsalis termino interrupta.

57. *Sciænini.* Cranium tumens, ossibus cavernosis conflatum: linea lateralis continua.

23. TRIGLIDÆ. Genæ loricatæ (laminæ suborbitales genam utrinque partim obtegentes cum præoperculo connexæ): radii spinosi plures in pinnis dorsi et anali, in ventralibus unicus.

58. *Cottini.* Pinnæ dorsales duo: caput vel rotundatum vel depressum.

59. *Scorpænini.* Pinna dorsalis unica.

60. *Triglini.* Pinnæ dorsales duo: caput parallelopipedum.

24. MULLIDÆ. Præoperculum margine integro: genæ non loricatæ: os parvum dentibus tenuibus: cirri duo sub mandibula retractiles: capitis et trunci squamæ latæ, facile deciduæ: radii spinosi plures in pinna dorsali antica, unus saltem in anali, et in utraque ventrali.

61. *Mullini.* Pinnæ dorsales binæ distinctæ.

25. PERCIDÆ. Laminæ operculares margine denticulato aut spinoso: genæ non loricatæ: dentes in maxillis, in vomere et fere semper in ossibus palatinis: pelvis ossibus humeralibus appensa: radii spinosi plures in pinnis dorsi et anali, in ventralibus unicus.

62. *Polynemini.* Pinnæ ventrales post pectorales: rostrum tumidum: pinnæ verticales squamosæ: radii pectoralium plures liberi, filiformes.

63. *Holocentrini.* Pinnæ ventrales, radiis plusquam quinque, sub pectoralibus: membranæ branchiostegæ radiis plusquam septem.

64. *Percini.* Pinnæ ventrales quinque-radiatæ sub pectoralibus: membranæ branchiostegæ radiis septem vel minus.

26. GOBIDÆ. Pinnæ ventrales infra pectorales ortæ, conjunctæ saltem ad basim in formam disci: radii spinosi pinnæ dorsalis graciles, flexiles: fissuræ branchiales parvæ.

65. *Gobini.* Corpus elongatum, parum compressum, antice incrassatum: squamæ minutæ. *Appendix tubulosa conica post anum, in utroque sexu.*

Ordo 9. CYCLOIDEI.

27. CYCLOPTERIDÆ. Pinnæ ventrales infra pectorales sitæ in discum suctorium conniventes: radii omnes pinnarum molles: corpus nudum!

66. *Cyclopterini.* Corpus tumidum: pinnæ pectorales jugulares latæ, membrana junctæ: operculum exiguum.

28. Blennidæ. Pinnæ ventrales ante pectorales, distinctæ, didactylæ: radii spinosi pinnæ dorsalis graciles, flexiles.

67. *Blennini.* Corpus elongatum, compressum, mucosum. *Appendix tubulosa conica post anum, in utroque sexu.*

29. Callyonimidæ. Pinnæ ventrales infra gulam insertæ, remotissimæ, pectoralibus ampliores: radii spinosi pinnæ dorsalis graciles, flexiles: apertura branchiali utrinque prope nucham exigua: corpus nudum!

68. *Callyonimini.* Corpus vix compressum, antice incrassatum, osse tympanico postice elongato, aculeato: oculi superi, approximati. *Appendix tubulosa conica post anum.*

30. Lophidæ. Pinnæ pectorales pedunculatæ: apertura subtus branchialis utrinque exigua operculis a cute contectis: radii anteriores pinnæ dorsalis subspinosi: corpus nudum: sceletum fere cartilagineum.

69. *Lophini.* Pinnæ ventrales longulæ, humero ante pectorales infixæ, quinque-radiatæ.

70. *Batrachini.* Pinnæ ventrales sub gula infixæ, angustæ, tri-radiatæ.

31. Gadidæ. Pinnæ ventrales sub gula infixæ, acuminatæ: pelvis ossibus humeralibus appensa: squamæ molles: radii omnes pinnarum molles.

71. *Ranicepini.* Caput latissimum, valde depressum: pinna dorsalis antica humillima, vix exserta.

72. *Gadini.* Corpus modice abbreviatum, parum compressum: caput congruum, vix unquam squamosum, cirro unico vel nullo: squamæ minutæ: pinnæ dorsales vel duo vel tres; analis sæpius duplex; caudalis sæpius furcata.

73. *Lotini.* Corpus elongatum, lubricum, postice compressissimum: caput magnum squamosum, cirro uno vel pluribus: pinna dorsalis una vel duo; analis unica; caudalis integra, plus minus rotundata.

32. Cyprinidæ. Pinna adiposa et intestina cæca nulla: maxillæ margo ab intermaxillaribus ossibus constitutus: rictus modicus: maxillæ debiles edentulæ: ossa pharyngea dentibus validis, specificis: radii branchiales tres: pinnæ ventrales post pectorales: pelvis ossibus humeralibus non appensa: radii pinnarum proprie spinosi nulli. *Cæteris piscibus minus carnivori.*

74. *Cyprinini.* Pinna analis imperforata: corpus mucosum, squamis profunde insitis, raris: os cirrosum.

75. *Leuciscini.* Pinna analis imperforata: corpus vix mucosum, squamis superficialibus densis: os non cirrosum.

33. PÆCILIDÆ. Pinna adiposa et intestina cæca nulla: maxillæ margo ab ossibus intermaxillaribus constitutus: rictus modicus: dentes in maxillis: radii branchiales plus quam tres: pinnæ ventrales post pectorales: pelvis ossibus humeralibus non appensa: radii pinnarum spinosi nulli.

76. *Anableptini.* Pupillæ duplices (vitta transversali corneam et iridem secante): pinnæ analis apex perforatus. *Vivipari.*

77. *Pœcilini.* Maxillæ depressæ, protractiles.

34. LABRIDÆ. Labia carnosa, duplicata: corpus oblongum: squamæ grandes: pinna dorsalis unica, radiis spinosis membrana plerumque appendiculatis: pelvis ossibus humeralibus appensa.

78. *Labrini.* Dentes maxillarum robusti, conici, inæquales.

79. *Scarini.* Dentes lamellosi, imbricati.

35. MUGILIDÆ. Caput depressum, squamis latis, etiam polygonaribus, tectum: labia crassa, inferum intus carinatum: cirri nulli: opercula integra: squamæ grandes: pinnæ dorsales duo, radiis spinosis pluribus ac in anali; ventrales paullo post pectorales, radio spinoso unico.

80. *Mugilini.* Pinna dorsalis antica, radiis tantum quatuor: dentes tenuissimi: squamæ simplices, deciduæ.

36. ATHERINIDÆ. Caput pyramidale, cute lævi obtectum: os valde protractile: labia tenuia: dentes minutissimi: cirri nulli: opercula integra: squamæ tenues, translucidæ: pinnæ dorsales duo, remotissimæ, radiis spinosis pluribus ac in anali; ventrales longe post pectorales, radio spinoso unico.

81. *Atherinini.* Corpus elongatum, fascia argentea longitudinali ad latera.

37. OPHIOCEPHALIDÆ. Cellulæ in pharyngeis ossibus superioribus ab eorum foliolis irregularibus dispertitæ! Radii pinnarum *omnes molles*: primus ventralium simplex. *Diu extra aquam vivere valent.*

82. *Ophiocephalini.* Corpus elongatum, fere cylindraceum: caput depressum scutis polygonis tectum: rostrum breve, obtusum: radii branchiales quinque: dorsalis pinna ac analis longissimæ; caudalis rotundata: linea lateralis continua.

38. Amidæ. Pinna dorsalis unica, radiata, longa: intestina cæca nulla: margo maxillæ ab intermaxillaribus ossibus in medio a maxillaribus in ramis constitutus: squamæ grandes: caput loricatum: radii pinnarum omnes molles: pelvis ossibus humeralibus non appensa.

83. *Amini.* Pinna analis brevis: radii branchiales duodecim: nares brevi tubo appendiculatæ: dentes antici, conici; postici tessellati: vesica aerea cellularis.

39. Clupeidæ. Pinna dorsalis unica, radiata: intestina cæca plurima: margo maxillæ ab intermaxillaribus ossibus in medio, a maxillaribus in ramis constitutus: squamæ grandes: caput non loricatum: radii pinnarum omnes molles: pelvis ossibus humeralibus non appensa.

84. *Erythrichtrini.* Caput rotundum, obtusum, minime squamosum, ossibus duris: genæ a suborbitalibus duris ossibus protectæ: pinna dorsalis ventralibus respondens: vesica aerea ampla.

85. *Clupeini.* Caput plus minus oblongum, acutulum, squamosum: genæ simplices: venter plerumque compressissimus, serratus: branchiæ late fixæ: pinna dorsalis varia: vesica aerea longa, acuta.

40. Salmonidæ. Pinna dorsalis antica, radiis omnibus mollibus; postica parva, adiposa, minime radiata: intestina cæca plurima: corpus valde squamosum: pelvis ossibus humeralibus non appensa.

86. *Scopelini.* Margo maxillæ ab ossibus maxillaribus ex toto constitutus: rictus amplissimus: dentes minimi: lingua et palatum edentula: radii branchiales minus quam duodecim: squamæ grandes, læves, deciduæ: pinnæ ventrales postpositæ: pinna dorsalis postica fere semiradiata!

87. *Aulopodini.* Margo maxillæ ab ossibus maxillaribus ex toto constitutus: rictus amplissimus: dentes numerosi, acutissimi, vel in lingua et ossibus pharyngeis: radii branchiales plus quam duodecim: corpus undique squamosum: squamæ grandes, adhærentes, ciliatæ: pinnæ ventrales præpositæ.

88. *Salmonini.* Margo maxillæ ab ossibus maxillaribus partim constitutus: rictus amplus: dentes sæpius acuti, serie unica vel duplici in ossibus maxillaribus, intermaxillaribus, palatinis, mandibularibus et pharyngeis, in vomere et lingua: squamæ parvulæ, integerrimæ: pinnæ ventrales postpositæ. *Ad hos spectant perfectissimi piscium quoad dentes.*

89. *Miletidini.* Margo maxillæ ab ossibus maxillaribus partim constitutus: dentes obtuse prismatici, corona tricuspide: rictus parvus: lingua et palatum edentula.

90. *Hydrocionini.* Margo maxillæ ab ossibus maxillaribus partim constitutus: rictus amplus: dentes conici vel acuti: vomer et lingua edentuli: genæ a lamina suborbitali protectæ.

41. Esocidæ. Pinna dorsalis unica, radiata, retroposita, radiis spinosis nullis ac in cæteris pinnis: intestina cæca nulla: maxillæ margo ab intermaxillaribus constitutus, aut maxillaria edentula occulta sub labiis: dentes in maxilla ac in longiore mandibula nonnulli acuti: corpus parce squamosum: pelvis ossibus humeralibus non appensa. *Voracissimi.*

91. *Esocini.* Pinnæ pectorales congruæ; dorsalis et analis breves, rotundatæ: corpus parce elongatum, cylindraceum, profundulum: squamæ duræ, grandiculæ: linea lateralis unica: rictus amplus: mandibulæ latæ, haud rostratæ: margo maxillæ a vomere et ab exilibus intermaxillaribus anterius constitutus, in ramis a maxillaribus elongatis: dentes pluriseriales in vomere, palato et lingua; uniseriales in intermaxillaribus et mandibula; pharyngeorum acuti.

92. *Belonini.* Pinnæ pectorales congruæ; dorsalis et analis longæ, falciformes: corpus valde elongatum, gracile, subquadratum, lineis lateralibus duabus: squamæ raræ, tenues: rictus parvus: mandibulæ longissimæ, angustæ, in rostrum acutum protractæ: margo maxillæ ab intermaxillaribus unice constitutus: dentes infra supraque uniseriales; in palato et lingua nulli; pharyngeorum hemisphærici.

93. *Exocetini.* Pinnæ pectorales maximæ, volatui aptæ!

42. Sphyrænidæ. Pinnæ dorsales duo remotæ, radiis spinosis pluribus ac in

anali; ventrales unico: intestina cæca plurima: dentes tantum in maxillis et in ossibus palatinis; canini plures valde acuti: corpus elongatum: laminæ operculares integræ: pelvis ossibus humeralibus non appensa.

94. *Sphyrænini.* Pinna dorsalis postica congrua.

95. *Paralepidini.* Pinna dorsalis postica exillima.

43. Trachinidæ. Pinna dorsalis unica, elongata, radiis spinosis pluribus; unus saltem in anali et in utraque ventrali: dentes in maxillis, in vomere et sæpe in ossibus palatinis: operculum aculeatum: pinnæ ventrales ante amplas pectorales: pelvis ossibus humeralibus appensa.

96. *Trachinini.* Genæ simplices.

97. *Uranoscopini.* Genæ pseudo-loricatæ (laminæ suborbitales latissimæ, posterius connexæ ossibus tympanicis, minime vero præoperculo).

44. Teuthydidæ. Corpus compressum, oblongum: os parvum, non protractile: dentes sectorii in utraque maxilla uniseriales: palatum et lingua edentula: radii spinosi plures in pinna dorsali, unus saltem in anali et in utraque ventrali.

98. *Teuthydini.* Pinna dorsalis unica.

45. Echeneididæ. Caput superne complanatum in disco ovali laminoso: pinnæ ventrales infra pectorales: pelvis ossibus humeralibus appensa: pinnarum radii omnes molles.

99. *Echeneidini.* Corpus fusiforme, elongatum: squamæ vix conspicuæ: pinna dorsalis anali opposita.

46. Mormyridæ. Corpus compressum, oblongum, squamosum: caput ultra opercula cute crassa obvolutum: os minimum: fissura branchialis parva, verticalis: intestina cæca duo: pelvis ossibus humeralibus non appensa: radii pinnarum omnes molles.

100. *Mormyrini.* Pinna dorsalis unica.

47. Gasterosteidæ. Genæ loricatæ! (laminæ suborbitales genas partim obtegentes cum præoperculo connexæ): radii pinnarum aliquot aculeati: pelvis ossibus humeralibus appensa.

101. *Gasterosteini.* Aculei aliquot liberi loco pinnæ dorsalis anticæ.

48. Scombridæ. Corpus quasi læve, squamulis parvulis: laminæ operculares

integræ: cauda robusta: pinnæ verticales squamis plerumque destitutæ, radiis spinosis pluribus; ventralibus unico.

102. *Centronotini.* Aculei aliquot liberi loco pinnæ dorsalis anticæ.

103. *Xiphiadini.* Pinna dorsalis unica, continua: rostrum ensiforme.

104. *Carangini.* Linea lateralis loricata!

105. *Bramini.* Pinna dorsalis et analis æquis ac in trunco squamis partim obtectæ! corpus compressum: palatum dentibus avenatum.

106. *Stromateini.* Pinna dorsalis unica, elongata, post pectorales orta, radiis spinosis interdum mollibus: corpus valde compressum: squamæ exiguæ: capitis vertex subrotundus.

107. *Coryphænini.* Pinna dorsalis unica, longissima, radiis spinosis interdum mollibus, dorsum universum fastigians: corpus cylindraceo-compressum, elongatum: squamæ exiguæ: capitis vertex acutus.

108. *Zeini.* Pinna dorsalis unica: corpus valde compressum, vix squamulosum: os valde protractile.

109. *Vomerini.* Pinnæ dorsales duo: corpus valde compressum, vix squamulosum: capitis vertex anceps.

110. *Scombrini.* Pinna dorsalis antica continua; postica in plures pinnulas spurias dirempta æque ac pars respondens analis: corpus fusiforme.

111. *Trichiurini.* Pinna dorsalis unica, continua: aculei multi exigui, liberi, in locum pinnæ analis saltem partim: corpus prælongum, valde compressum: rostrum elongatum: os profunde fissum.

49. Cepolidæ. Corpus prælongum, valde compressum: squamæ minutæ: rostrum breve: os parvum, parum aut oblique fissum: radii spinosi plures in pinnis dorsali ac anali, unus in ventralibus.

112. *Cepolini.* Pinna dorsalis unica, longissima.

50. Ophididæ. Corpus ensiforme, lubricum: opercula manifesta: fissuræ branchiales grandes: squamæ parvulæ cuti intrusæ: omnes pinnarum radii molles: pinnæ ventrales nullæ.

113. *Ophidini.* Rostrum obtusum, non extensile: pinna dorsalis, analis, et caudalis acuta, omnes conjunctæ.

114. *Ammodytini.* Rostrum acutum: maxilla extensilis ultra longiorem

mandibulam: pinna dorsalis longa; analis et caudalis bifurcæ, omnes distinctæ.

51. Murænidæ. Corpus prælongum, cylindraceum, lubricum: opercula parva, sub cute latentia: fissuræ branchiales minimæ: squamæ tenuissimæ, cuti intrusæ: pinnæ ventrales nullæ: omnes pinnarum radii molles.

115. *Murænini.* Aperturæ branchiales tubulatæ.

116. *Gymnonotini.* Aperturæ branchiales ante pinnas pectorales, membrana partim tectæ.

117. *Synbranchini.* Apertura branchialis foramine unico subgulari: pinnæ verticales subadiposæ.

118. *Apterichtrini.* Aperturæ branchiales subgulares proximæ: pinnæ vel fere, vel omnino nullæ.

Subclassis 4. MARSIPOBRANCHII.

Sectio 6. CYCLOSTOMI.

Ordo 10. HELMINTHOIDEI.

52. Petromyzonidæ. Corpus elongatissimum, cylindraceum, nudum: pinnæ sine radiis.

119. *Petromyzonini.* Foramina branchialia ad colli latera utrinque septem.

120. *Gastrobranchini.* Foramina branchialia bina gularia.

XVII. *Description of a new Genus of Plants belonging to the Natural Family* Bignoniaceæ. *By* David Don, *Esq., Libr. L.S., Prof. Bot. King's Coll. Lond.*

Read November 20th, 1838.

THE interesting subject of the present paper formed part of a small but valuable collection obtained during a journey through the interior of Southern Africa to the western coast, by Captain Sir James Edward Alexander, who has recently given to the world the result of his observations on those hitherto little known regions, and who obligingly presented to me the specimen whence the accompanying drawing and description were taken, and which happened to be the only one of the plant he collected. It was discovered by that enterprising traveller, growing in dry arid soil, in the open desert, called the Great Flat or Kei Kaap, in Great Namaqua Land, in 25 S. latitude, and 17 E. longitude. The plant was but just then in flower, so that the fruit even in an early state is still a desideratum. Sir James Alexander represents it as a thorny bush, about six feet high, with several straight, nearly simple, twiggy stems, bearing small hoary wrinkled leaves, and white flowers. Indeed the whole aspect of the plant bespeaks the aridity of the region in which it grows.

There can be no doubt that the plant does really belong to the *Bignoniaceæ*, although in habit it bears a stronger resemblance to *Verbenaceæ*, especially to *Duranta* and *Gmelina*, and, in the absence of both flower and fruit, one would never suspect that the specimen pertained to a Bignoniaceous plant. In its spathaceous calyx, and in its regular funnel-shaped corolla, the genus comes near to *Spathodea*, but is abundantly distinguished from it by the cells of the anthers being parallel, and connate from the middle upwards. The ovarium I have only seen in a very young state, and I am therefore unable to say anything concerning the probable condition of the mature fruit or of the seeds. On the specimen are two fully expanded flowers and a bud. The calyx in all

three has six teeth, and both the expanded flowers have a six-cleft limb; one of these is furnished with seven stamens, and the other, as well as the bud, with six. The stamens are erect, nearly equal in length, and partly project beyond the tube of the corolla. The flowers are therefore completely regular, and, from the circumstance of the two expanded flowers and the bud having a six-lobed limb to the corolla, and being furnished with six or sometimes even with seven stamens, we may justly conclude that the normal number is really six in this plant; but had there been only a single flower, I should have regarded the excess of lobes and stamens as an accidental occurrence, and the normal number as five, as in those species of *Spathodea* which have the fifth stamen perfectly developed, and the flower consequently pentandrous.

The following are the characters of this new genus:

CATOPHRACTES.

Syst. Linn. Hexandria Monogynia.

Ord. Nat. Bignoniaceæ. *Br.*

Character Essentialis.

Calyx spathaceus, hinc fissus, inde 6-dentatus. *Corolla* infundibuliformis: *limbo* 6-lobo, patenti, æquali. *Stamina* 6, raró 7, subæqualia, exserta. *Antherarum* loculi paralleli, e medio sursùm connati. *Ovarium* abbreviatum, conicum, biloculare?

Frutex (namaquensis) *erectus, spinosus.* Folia *fasciculata, simplicia, penninervia, crenato-serrata.* Flores *laterales, subsessiles, speciosi, albi.*

Descriptio.

Frutex erectus, rigidus, spinosus, orgyalis, basi multidivisus. *Caules* plures, virgati, simpliciusculi, obsoletè tetragoni, cortice spadiceo, pube stellatâ brevissimâ, præsertim apicem versus, densè canescenti-tomentosi. Spinæ (gemmæ primariæ mutatæ) supra-axillares, decussato-oppositæ, subulatæ, validæ, horizontaliter porrectæ, vix pollicares. *Folia primaria* nondùm vidi; *secundaria* in ramulis parùm evolutis fasciculata, simplicia, petiolata, ovalia v. cuneata, retusa, levitèrque emarginata, grossè æqualitèrque crenato-serrata, coriacea, semipollicaria, penninervia, subtùs costata,

suprà transversè subplicata, pube stellatâ utrinque densè tomentosa, incana. *Petioli* brevissimi, teretiusculi, tomentosi, inarticulati. *Flores* in ramulis foliiferis laterales, pauci (3), subsessiles, speciosi. *Pedunculi* brevissimi, crassi, teretes, densè tomentosi, vix sesquilineam longi. *Calyx* tubulosus, spathaceus, membranaceus, subtùs tertiâ parte fissus, parùm ventricosus, undique pilis ramosis albidis copiosissimè vestitus, apice 6-dentatus: *dentibus* subulatis, erectis, brevibus, lanatis. *Corolla* ampla, alba, regularis, infundibuliformis: *tubo* calyce subduplò longiore, basi intùs villoso, sursùm dilatato: *limbo* 6-fido, patenti: *lobis* cuneato-rotundatis, subæqualibus, integris, venosissimis, margine paululùm incurvis, undulatis et subrepandis, æstivatione imbricatis. *Stamina* 6, raro 7, erecta, subæqualia: *filamenta* compressa, glabra, corollæ tubo infrà adhærentia, imâ basi barbata: *antheræ* exsertæ, incumbentes, biloculares, utrinque obtusæ, apice subrecurvatæ: *loculis* longis, parallelis, è medio sursùm connectivo prominenti connatis, suturâ longitudinali dehiscentibus. *Ovarium* abbreviatum, conicum, compressum, villosissimum, biloculare? basi annulo carnoso integerrimo cinctum. *Stylus* tenuis, compressus, glaber, vix staminum longitudine. *Stigma* bilamellatum: *laciniis* subrotundo-ovatis, planis, dilatatis, superficie margineque minutissimè papillosis. Fructus mihi ignotus.

Species unica. C. Alexandri. Tab. XXII.

Crescit spontè in Africæ Australis Terræ Namaquensis deserto magno Kei Kaap v. Great Flat a Colonis dicto, lat. 25. long. 17. Fl. Martio. *J. E. Alexander, Equ. Aur.* ♄. (v. s. sp. sine fructu.)

The most remarkable characters of this plant, and which separate it from all other known genera of *Bignoniaceæ*, consist in its regular symmetrical flowers, having an unusual number both of divisions and stamens. In the form of its calyx and corolla it agrees, as we have already stated, with *Spathodea*, and in the parallel cells of its anthers and exserted stamens, with *Millingtonia.* From the shortness of the ovarium, we suspect that a considerable difference will be presented by the mature fruit from the rest of its coordinates. The habit, as already noticed, is altogether that of *Verbenaceæ.*

From the position which the *Bignoniaceæ* occupy in the series of natural

affinities, and connected, as they are, on the one hand with the symmetrical families *Cobœaceæ*, *Polemoniaceæ*, and even *Apocyneæ*, and on the other with the unsymmetrical ones of *Cyrtandraceæ*, *Acanthaceæ*, *Pedalineæ*, *Sesameæ*, and *Scrophularineæ*, we need not be surprised to find amongst them genera with perfectly symmetrical flowers.

The generic name refers to the peculiar situation of the leaves and flowers below the spines, and is compounded of *κάτω*, *infra*, and *φρακτὸς*, *munitus*. Its enterprising discoverer is commemorated in the specific name.

EXPLANATION OF TAB. XXII.

Fig. 1. Upper portion of a stem of *Catophractes Alexandri*.
Fig. 2. Tube of the corolla laid open, with the stamens.
Fig. 3. Pistillum; all of the natural size.

Note.—Since the preceding account was read before the Society, I have been favoured by Mr. Burchell with flowering specimens of two species of his remarkable genus *Rhigozum*, namely *R. spinosum* and *obovatum*, and by Mr. Bentham with a specimen of the latter species, with two separate fruit. These plants agree well with the present in habit, but the calyx is short, wide, and campanulate, with an equal limb, neither cloven, nor spathaceous; the corolla has a very short tube, much narrower than the calyx, with the faux much dilated, ventricose, and campanulate; the stamens are unequal in length, two of them being longer than the rest. The margin of the leaves in all the species of *Rhigozum* hitherto known is perfectly entire. From these differences, therefore, it is evident that *Catophractes* must either constitute a distinct genus, or a very marked section if united to *Rhigozum*. It clearly forms the transition from that genus to the pentandrous simple-leaved *Spathodeæ*.

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XVIII. *Descriptions of the Indian Species of* Iris. *By* David Don, *Esq., Libr. L.S., Prof. Bot. King's Coll. Lond.*

Read December 18th, 1838.

I AM indebted to my friend and colleague Dr. Royle for the opportunity of presenting to the Linnean Society the following account of several interesting species of the beautiful genus *Iris*, derived from materials collected by him during his sojourn in the countries forming the north-west boundary of British India. Dr. Royle's collection contains four species of this genus, one of which is entirely new, the other three being identical with those in the Wallichian Herbarium, which besides comprises two additional species: one of them, gathered in Ladak by that enterprising traveller, the late Mr. Moorcroft, and closely related to the *Iris biglumis* of Vahl, I have included in this paper; the other is from Armenia, and is the *Iris reticulata* of the "*Flora Taurico-Caucasica*," although recorded, apparently on the authority of M. Belanger, as *Iris persica* in Wallich's Catalogue. The number of species therefore actually belonging to the Indian Flora is five.

The species of this genus naturally divide themselves into two groups, which are characterized by certain differences in their structure and œconomy, and in some degree by their geographical distribution. The first group have scariose spathes, a distinct tube, the sepals bearded, and the petals broader, and overlapping each other at their extremities. To this group belongs the far greater part of the European species, which are also remarkable for being early-flowering, the broad convergent petals serving to protect the stamens and pistil from the effects of the weather during the period of their blossoming, and the bearded crest of the sepals is doubtless for the purpose of brushing out and retaining the pollen until taken up by the recurved stigmas, whose absorbing apices are brought into close contact with it; the anthers are directly opposed to the crest, and their cells face outwards. The second

group, which is principally confined to Asia and America, is distinguished by having the spathes frequently leafy, a tube continuous with the ovarium, and often very short; by their beardless sepals; and by the petals being smaller and spreading. The species of this group produce their flowers generally later in the season; a circumstance which, together with their being chiefly inhabitants of a drier climate, renders the protection of the petals less necessary. Our own Flora affords two examples of this section in *Iris fœtidissima* and *Pseudacorus.* The very early period of flowering of the *Iris fœtidissima* may be supposed to afford a strong objection to the theory as to the use of the convergent petals in the first group of the genus; but the plant is well known to occur only in sheltered situations, where a considerable degree of protection is afforded to the flowers. Of the five Indian species, which I shall now proceed to describe, two belong to the first group, and three to the second.

Sect. 1. Euiris.

Perianthii tubus distinctus, subinfundibuliformis. *Sepala* recurvata, barbata. *Petala* maxima, invicem apice incumbenti conniventia. *Spathæ persæpè scarioso-membranaceæ.*

1. *I. nepalensis,* barbata; scapo tereti lævi plurifloro foliis ensiformibus plerumque longiore, spathis vix foliaceis subæqualibus, sepalis omnibus emarginatis, ovario obtusè trigono perianthii tubi infundibuliformis vix longitudine.

Iris nepalensis. *Wall.Cat. n.* 5050. *Lindl. in Bot. Reg. t.* 818. *Royle Ill. t.* 90. *f.* 2.

I. japonica. *Thunb. in Linn. Trans.* 2. *p.* 327?

I. squalens. *Ejusd. Fl. Japon. p.* 33?

β. scapo indiviso subbifloro foliis breviore.

Habitat in Nepaliæ montibus (*Wallich*); in Emodi montibus Bychuky Ghaut inter Pabur et Tonse, et in Surkunda ad Vicum Bhala Gau. *Royle.* ♃. (v. s. sp. in Herbb. Wall. et Royle.)

Rhizoma oblongum, teres, crassum, ramosum, repens, odore gratissimo *Iridis florentinæ. Scapus* erectus, teres, lævis, subflexuosus, fistulosus, 2—5-florus, pedalis v. sesquipedalis. *Folia* ensiformia, acuminata, nervosa, subfal-

cata, glauco-viridia, scapo plerumque breviora, unciam et ultrà lata, infernè angustata. *Flores* ferè omninò *I. germanicæ*. *Spathæ* subæquales, lanceolatæ, acuminatæ, conduplicatæ, subfoliaceæ, margine scarioso-membranaceæ. *Sepala* 3 *exteriora* recurvato-patentia, spathulata, emarginata, violacea, infernè albicanti-variegata, barbâ albâ copiosâ munita, brevitèr unguiculata, elliptico-oblonga, profundiùs emarginata, invicem se convergentia, undulata, intensiùs colorata, costâ prominenti; omnia præter ad apicem margine integerrima: *tubus* infundibuliformis, obscurè trigonus, vix uncialis. *Ovarium* obtusè trigonum, ¾-unciam longum. *Stigmata* (Styli rami) bifida: *lobis* conniventibus, acutis, hinc levitèr serrulatis.

There can be no doubt that the present species comes very near to *Iris germanica*, and indeed the points which separate them are few, and these not strongly contrasted. That species is, however, distinguished by its shorter scariose and ventricose spathes, entire sepals, longer and slenderer tube, and lastly, by the more coarsely serrated lobes of its stigmas. The rhizoma has the fragrance of that of *Iris florentina*, and Dr. Royle informs me that it is employed by the natives for similar purposes.

I suspect that this species will prove to be identical with the *Iris japonica*, notwithstanding the difference presented by the colour of their flowers, that of Thunberg's plant being described to be white: for I have elsewhere remarked upon the fallacious character afforded by colour, as a test of specific distinction, not only in this genus, but throughout the greater part of the Monocotyledonous class, as is beautifully illustrated by the numerous cultivated varieties of *Iris Xiphium* and *Xiphioides*. A series of careful experiments are still wanting to determine the exact limits of species in this genus.

The variety β. differs in nothing except in its shorter two-flowered scape, and there are cultivated specimens of *nepalensis* from the Calcutta Garden in the Wallichian Herbarium having this depressed character. In my character of the species given in the Proceedings of the Linnean Society, I have described the stem as compressed and furrowed; but these appearances presented by the dried specimens prove to be the mere result of desiccation.

2. *I. kamaonensis*, barbata; scapo brevissimo unifloro, tubo perianthii lon-

gissimo subfiliformi, sepalis interioribus bilobis longè unguiculatis, ovario turbinato 3-gono.

Iris kamaonensis. *Wall. Cat. n.* 5052.

Habitat in Emodi montibus ad Kedarkanta (*Royle*) ; Bydrunauth. *Blinkworth.* ♃. Floret Augusto. (v. s. sp. in Herbb. Wall. et Royle.)

Rhizoma repens, noduloso-ramosum, cæspitosum, suprà rudimentis foliorum fibrosis coronatum, infrà munitum fibris crassiusculis. *Scapus* erectus, teres, gracilis, uniflorus, brevissimus, vix sesquipollicaris, foliis omninò obvolutus. *Folia* lineari-ensiformia, apice subadunco acuta, striata, lenta, viridia, 3—6-pollicaria, 2 lineas lata; exteriora latiora, imperfectè evoluta, scarioso-membranacea, imbricato-vaginantia. *Flos* magnitudine *I. flavissimæ. Spathæ* inæquales, lanceolatæ, acutæ, conduplicatæ, foliaceæ, margine angustè membranaceæ; altero (interiore) breviore. *Sepala* sanguinea, maculis atropurpureis notata; 3 *exteriora* recurvata, spathulata, levitèr emarginata, barbâ copiosâ lutescente munita; 3 *interiora* (petala) cuneata, longè unguiculata, biloba, conniventia: *tubus* gracilis, subfiliformis, 2-uncialis et ultrà, supernè dilatatus. *Ovarium* turbinato-oblongum, 3-gonum, 3-costatum, semunciale et ultrà. *Stigmata* (Styli rami) rosea, divaricato-patentia, apicibus incurvatis, bilobis, lobis integerrimis.

This is a very distinct and beautiful species. The form of its inner sepals, and the great length of the tube of the perianthium, as well as its turbinate ovarium, essentially distinguish it from every other; and indeed there are none with which it can well be contrasted.

The sepals are of a red colour, and elegantly mottled with dark purple spots.

We may hope to see this elegant species shortly introduced to our gardens by means of Dr. Falconer, the able successor of Dr. Royle in the superintendence of the Honourable East India Company's botanic garden at Saharunpore, and who, I am happy to learn, is carrying out the observations and experiments so happily commenced by that zealous naturalist.

Sect. 2. Xiphioides.

Perianthii tubus solidus, cum ovario continuus, persæpè brevissimus. *Sepala* imberbia. *Petala* angustiora, patentia. *Spathæ plerumque foliaceæ.*

3. *I. decora*, imberbis; scapo tereti subtrifloro, foliis lineari-ensiformibus, sepalis subæqualibus bilobis recurvis; exterioribus membranaceo-cristatis, perianthii tubo filiformi ovario triquetro duplò longiore, stigmatibus dilatatis serratis conniventibus, seminibus apice carunculatis.

Iris decora. *Wall. Pl. Asiat. Rar.* 1. *p.* 77. *t.* 86.

I. sulcata. *Ejusd. Cat. n.* 5049.

I. nepalensis. *Don Prodr. Fl. Nepal. p.* 54.

I. orientalis. *Thunb. in Linn. Trans.* 2. *p.* 328.?

I. sibirica. *Ejusd. Fl. Japon. p.* 33.?

Habitat in Nepaliæ montibus ad Bempedi et Ekdanta (*Wallich*); in Emodi montibus ad Choor et Punjee. *Royle, Blinkworth.* ♃. Floret Maio. (v. s. sp. in Herbb. Wall. et Royle.)

Rhizoma truncatum, grumosum, ferè *Hemerocallidis flavæ*, fibris infernè incrassatis fusiformibus, suprà rudimentis foliorum emarcidorum fibrosis copiosè vestitum. *Scapus* erectus, teres, lævis, flexuosus, fistulosus, simpliciusculus, 3- v. raró 5-florus, spithamæus, pedalis v. cubitalis. *Folia* lineari-ensiformia, acuminata, tenuiora, membranacea, nervis prominentibus costata, hinc pallidiora, glaucescentia, inde gramineo-viridia, scapi longitudine, 4—5 lineas lata. *Flores* pulcherrimi. *Pedunculi* breves, hinc convexi, inde plani. *Spathæ* foliaceæ, subæquales, lanceolatæ, acuminatæ, conduplicatæ, margine scariosæ. *Sepala omnia* spathulata, biloba, recurvato-patentia, pallidè lilacina; *exteriora* 3 vix majora, pulchrè purpureo-venosa, cristâ lineari membranaceâ serrulatâ lutescenti è basi ad medium usque longitudinalitèr coronata: *tubus* subfiliformis, uncialis, spatham superans. *Ovarium* 3-angulare, tubo perianthii duplò brevius. *Stigmata* (Styli rami) ampla, cuneata, bipartita, erecto-conniventia, pallidè lilacina, ferè longitudine sepalorum: *lobis* cuspidatis, hinc margine argutè serratis. *Capsula* elliptico-oblonga, triquetra, lævis, utrinque attenuata, 3-locularis, 3-valvis, fuscescens, sesquipollicaris, stylo elongato persistenti coronata. *Semina* in quoque loculo numerosa, crebrè biserialia

hinc convexa, inde biangulata, raphe pallidiori elevatâ aucta, apice appendice obtusâ fungosâ carunculata, basi hilo parvo instructa: *testa* coriacea, rugosa, brunnea, epidermide laxâ, pallidè fuscâ: *albumen* copiosum, cartilagineo-carnosum, album. *Embryo* teres, medio paululùm constrictus, clavatus, albus, extremitate radiculari (cauliculari) crassiori.

This species departs from the rest of the genus in so many points, that it may safely be ranked with those which, like *Iris tuberosa* and *Sisyrinchium*, appear to constitute the types of so many distinct sections. The rhizoma is exactly that of *Hemerocallis*, being furnished with thickened fusiform fleshy fibres, and the leaves are likewise remarkable for the diversity of colour of both surfaces, the inner one being of a bright green, and the outer one glaucous. The sepals are uniform, bilobed, and recurved, the outer three being furnished along their centre with a peculiar membranous crest or fold. The stigmas are remarkably broad and connivent. The seeds are furnished at their apex with a thick, compressed, fungous appendage, resulting from an unusual development of the testa at that point.

This species has been introduced to our collections by Dr. Wallich, and is remarkable for the elegance of its habit and the beauty of its flowers.

I have referred under this species Thunberg's *Iris orientalis*; but an examination of authentic specimens is necessary to solve our doubts on this point.

4. *I. longifolia,* imberbis; foliis margine scabris, scapo brevissimo unifloro, sepalis sublanceolatis integerrimis, tubo perianthii vix ullo, ovario elongato triquetro scapum adæquante, stigmatis lobis integerrimis.

Iris longifolia. *Royle Ill. t.* 91. *f.* 2.

Habitat in Cashmeriâ. *Royle.* ♃. (v. s. c. in Herb. Royle.)

Rhizoma repens, oblongum. *Scapus* uniflorus, gracilis, triangularis, foliis omninò obvolutus, 2—3-pollicaris. *Folia* lineari-ensiformia, acuta, recurvato-falcata, firmiora, coriacea, lævia, viridia, margine præsertim apicem versus tenuissimè serrulata, bipedalia, ferè semunciam lata. *Flos I. halophilæ.* *Spathæ* subæquales, foliaceæ, conduplicatæ, florem superantes. *Sepala* sublanceolata, integerrima, recurvato-patentia, intensè cœrulea; *exteriora* 3 duplò majora, imberbia, infernè albicantia, purpureo-venosa: tubus vix ullus. *Stigmata* (Styli rami) angustiora, biloba, recurvato-

patentia, sepalis interioribus (petalis) breviora et similitèr colorata: *lobis* ovatis, acutiusculis, integerrimis, divaricatis. *Ovarium* angustissimum, triquetrum, 2½-pollicare, sursùm crassius.

Although this bears a considerable resemblance to *Iris halophila*, and even to *fœtidissima*, it is nevertheless essentially different from either: the extremely short scape, and minutely serrulate leaves, will distinguish it from every other species hitherto recorded of this group.

The specimen in Dr. Royle's Herbarium is a cultivated one, the plant having been raised in the Saharunpore botanic garden from Cashmere seeds.

5. *I. Moorcroftiana*, imberbis; scapo bifloro pedunculis breviore, spathis glumaceis tubum perianthii subæquantibus, sepalis lanceolatis acutiusculis, ovario 6-sulcato.

Iris Moorcroftiana. *Wall. Cat. n.* 5051.

Habitat in Ludak. *Moorcroft.* ♃. (v. s. sp. à b. Moorcroft lecta in Herb. Wall.)

Rhizoma cæspitosum, fibris numerosis filiformibus ramulosis instructum, et suprà foliorum emarcidorum rudimentis scariosis v. fibrosis imbricatis coronatum. *Scapus* teres, indivisus, biflorus, pollicaris, foliis omninò immersus. *Folia* stricta, angustè lineari-ensiformia, rigida, nervosa, coriacea, 4—6-uncialia, vix 2 lineas lata, apice acutiusculo subadunco. *Flores* pallidè cœrulei, pedunculati, pedunculis subfiliformibus, sesqui v. bipollicaribus. *Spathæ* glumaceæ, lanceolatæ, acutiusculæ, convolutæ, margine latè scarioso-membranaceæ; alterâ (exteriore) tubum perianthii subæquante. *Sepala* lanceolata, acutiuscula; *interiora* 3 parùm angustiora; omnia imberbia, integerrima: *tubus* brevissimus, angustus, 6-sulcatus, æqualis. *Ovarium* unciale, teretiusculum, 6-sulcatum. *Stigmata* (Styli rami) sepalis interioribus latiora, biloba: *lobis* inæquilateri-ovatis, acutiusculis, integerrimis.

We have already remarked upon the intimate affinity existing between this species and *Iris biglumis*, discovered by Pallas in Eastern Siberia, and of which there exist two specimens in the Linnæan Herbarium, which had been communicated to Linnæus by that distinguished traveller and naturalist. Of

these specimens, as well as of many others sent by Pallas, and which had reached the great Swedish Naturalist towards the close of his earthly career, we find no mention in any of his works; and it appears from the papers on which they are pasted, that even the charge of placing them into the Herbarium had been committed to his son.

The chief points of difference between this species and *biglumis* are its lengthened peduncles and narrower sepals: for in other respects they are so much alike. that, without a very careful examination, the specimens might readily be confounded.

My knowledge of the colour of the flowers of this and the preceding species is derived from a series of very beautiful drawings in the possession of Dr. Royle.

XIX. *An Account of the Indian Species of* Juncus *and* Luzula. *By* David Don, *Esq., Libr. L.S., Prof. Bot. King's Coll. Lond.*

Read January 15th, 1839.

THE *Junceæ*, like the other Glumaceous families, but especially the *Cyperaceæ* and *Gramineæ*, have a very wide geographical range, extending throughout the globe from the equator to the polar regions, and affording examples of the occurrence in both hemispheres of the same species, or at least of forms too closely allied to admit of their being ranked as distinct species, as for instance *Juncus effusus* and *maritimus*, and *Luzula campestris*; but the *Cyperaceæ* afford still more numerous examples, and among others may be mentioned *Carex cæspitosa* and *Pseudo-Cyperus*, *Cladium Mariscus*, *Scirpus lacustris*, *triqueter*, and *maritimus*, *Isolepis fluitans* and *setacea*.

The number of species collected by Dr. Royle in Northern India is eight, of which seven belong to *Juncus*, and one to *Luzula*. This last is common to Europe, the northern parts of Asia, and Greenland. Of the seven *Junci* three are entirely new, two are identical with those contained in the Wallichian Herbarium, and two are generally diffused throughout Europe.

The linear, erect anthers, attached by their base to the filaments, and composed of two parallel cells, connate throughout their entire length, and their filiform, longitudinally papillose stigmata, combined with their habit and narrow sheathing leaves, clearly establish a close relationship between the normal *Junceæ* and *Cyperaceæ*, notwithstanding the reduced condition of the perianthium and ovarium, the uninclosed embryo, and entire leaf-sheaths in the latter family.

The *Junceæ* evidently form the transition from the Glumaceous to the Petaloid Monocotyledons, being connected on the one hand by *Narthecium* with *Asphodeleæ* and *Melanthaceæ*, by *Kingia* and *Calectasia* with *Commelineæ* and

Palmeæ, and by *Burmanniaceæ* with *Irideæ*; and on the other hand, by means of *Restiaceæ,* with *Xyrideæ* and *Cyperaceæ.*

I have divided the species into sections, which appear to constitute very natural groups, and they will be found to facilitate our knowledge of individual species. This arrangement is founded in a great measure upon the suggestions contained in Mr. Brown's invaluable work on the Flora of New Holland.

Gen. I. JUNCUS.

* *Stamina* 6. *Semina scobiformia. Inflorescentia terminalis, capitata. Folia plana, aversa.*

1. *J. leucanthus,* culmo bifolio tereti, foliis margine involutis filiformibus culmum subæquantibus, capitulo terminali solitario 6—10-floro, involucro 5-phyllo glumaceo floribus longiore, sepalis acutiusculis, antheris acutis filamentis duplò longioribus, ovario incluso, stigmatibus stylo ter brevioribus.

Juncus leucanthus. *Royle MSS.*

Habitat in Emodi montibus ad Shalma. *Royle.* ♃. Floret Junio. (v. s. sp. in Herb. Royle.)

Rhizoma repens, atrofuscum, fibris capillaceis vestitum. *Culmi* erecti, filiformes, graciles, striati, bifoliati, 5—6-pollicares, basi vaginati: *vaginâ* semipollicem longâ, è squamis (foliis abortivis) imbricatis, brunneis, nitidis compositâ. *Folia radicalia* recurvato-patentia, marginibus omninò involutis subfiliformia, obtusa, glabra, viridia, culmi ferè longitudine; *culmorum duo* longè vaginata, inferiore apice elongato foliaceo, bipollicari, superiore apice brevissimo: *vaginæ* semunciales et ultrà, cylindraceæ, læves, apice biauriculato-membranaceæ. *Capitulum* terminale, 6—10-florum, 5-bracteatum. *Bracteæ* ovato-oblongæ, acutæ, parùm inæquales, multinerviæ, brunneæ. *Flores* albi, brevissimè pedicellati, bracteis breviores. *Pedicelli* ancipiti-compressi, supernè membranaceo-bialati. *Sepala* ovato-lanceolata, acutiuscula, scarioso-membranacea, concava, 3-nervia (nervis medio approximatis, parallelis); *exteriora* 3 parùm latiora. *Stamina* 6, subæqualia, perianthio multò breviora: *filamenta* complanata,

dilatata: *antheræ* filamentis duplò longiores, lineares, acutiusculæ, basi obtusæ, biloculares: *loculis* parallelis, omninò connatis. *Pistillum* stamina vix superans: *ovarium* subrotundo-ovatum, 3-gonum, 3-loculare, multi-ovulatum, perianthio duplò brevius: *stylus* tenuis, ovario longior: *stigmata* 3, obtusa, recurvata, stylo ter breviora, longitudinalitèr papillosa.

This forms a highly interesting addition to the genus, being nearly related to *J. triglumis*, from which, however, it differs in several important particulars. The leaves are recurved, and nearly as long as the stems; the bractes forming the involucrum are five in number, longer than the flowers, and pointed. The capitula have from six to ten flowers, and the sepals are narrower and somewhat acute; the anthers are also acute, and they are double the length of the dilated filaments. The stigmata are thrice shorter than the style, and the ovarium is rounded-ovate, and it may be supposed that the mature fruit will prove to be considerably shorter than the sepals. Moreover the rhizoma is creeping, and the sheaths at the base of the stems are much longer, dark brown and shining. These characters sufficiently distinguish it from *triglumis*, in which the capitula are mostly 3-flowered, more rarely 2- or 4-flowered, the sepals and bractes obtuse, and the flowers longer than these last. The anthers are obtuse, and four times shorter than the narrow simple filaments; stigmata as long as the style; ovarium longer than the sepals; and lastly, the leaves are only half as long as the stems, with the cauline ones extremely short. The root is besides not creeping.

This new species was discovered by Dr. Royle on Shalma, a mountain of the Himalaya range, having an elevation of 10,000 feet above the level of the sea.

2. *J. leucomelas*, culmo enodi filiformi aphyllo, foliis subulatis canaliculatis, capitulo terminali 3—5-floro involucro 3-phyllo acuto breviore, sepalis obtusis, antheris filamentorum ferè longitudine, capsulâ acuminatâ perianthio longiore.

Juncus leucomelas. *Royle MSS.*

Habitat in Kunawur ad Soongnum. *Royle.* ♃. (v. s. sp. in Herb. Royle.)

Species elegantissima! Perennis, cæspitosus. *Rhizoma* subbulbosum, fibris

tenuissimè capillaceis instructum. *Culmi* stricti, continui, filiformes, graciles, nudi, læves, virides, 2—3-unciales. *Folia* omnia radicalia, subulata, obtusa, subrecurvata, lætè viridia, lævissima, suprà angustè canaliculata, apice teretiuscula, basi dilatatâ, membranaceâ, striatâ, culmos longè vaginantia, iisdemque multò breviora. *Capitulum* terminale, solitarium, 3—5-florum, involucratum: *bracteis* 3 v. 4, ovatis lanceolatisve, acutis, valdè inæqualibus, concavis, nervosis, ferrugineis, nitidis; *extimo* multò longiore, apice subulato. *Sepala* lanceolata, obtusa, 3-nervia, alba, scarioso-membranacea, 3 lineas longa; *interiora* 3 parùm angustiora. *Stamina* 6, subæqualia, perianthio longiora. *Filamenta* alba, complanata, basi dilatata. *Antheræ* lineares, obtusæ, basi affixæ, erectæ, filamentorum ferè longitudine, biloculares: *loculis* parallelis, omninò connatis. *Pistillum* staminibus brevius: *ovarium* ovato-oblongum, attenuatum, triquetrum, 3-loculare, loculis multi-ovulatis: *stylus* ovario brevior: *stigmata* 3, brevia, obtusa, recurvato-patentia, longitudinalitèr papillosa. *Capsula* ovato-oblonga, acuminata, 3-locularis, badia, perianthio multò longior.

This is undoubtedly by far the most elegant species of the genus, and although clearly belonging to the present section, there is no other species with which it can well be compared. The flowers are pure white, larger than usual in the genus, and arranged in a terminal capitulum, furnished with an involucrum composed of 3 or 4 large scariose bractes of a dark ferruginous brown. The anthers are remarkable for their length, equalling that of the filaments. The stems are continuous, and without either articulation or leaf.

The species is from Soongnum in Kunawur, a country situate beyond the Himalaya, between 31° 33′ and 31° 50′ N. latitude.

3. *J. membranaceus*, culmo tereti subdiphyllo, foliis subfiliformibus obtusis, capitulo terminali solitario 4—8-floro bracteâ communi membranaceâ breviore, sepalis obtusis capsulâ acutâ longioribus, staminibus inclusis, antheris filamentis dilatatis ter brevioribus.

Juncus membranaceus. *Royle MSS.*

Habitat in Emodi montibus ad Punjee. *Royle.* ♃. (v. s. sp. in Herb. Royle.)

Perennis, cæspitosus. *Culmi* erecti, filiformes, graciles, fistulosi, subdiphylli, spithamæi et ultrà, basi foliis imperfectè evolutis squamiformibus obvo-

lutâ. *Folia* obtusa, canaliculata, lævissima, lætè viridia, subindè marginibus involutis subfiliformia, culmis plerumque breviora, basi longè vaginantia; *suprema* sæpiùs abbreviata. *Vaginæ* ampliatæ, fissæ, membranaceæ, striatæ, apice biauriculatæ. *Capitulum* terminale, solitarium, 4—8-florum. *Flores* albi, subsessiles, majusculi. *Bracteæ partiales* ovato-lanceolatæ, mucronatæ, nervosæ, scariosæ, albæ, nitidæ; *communi* majore, capitulo duplò longiore, dilatatâ, membranaceâ, cucullatâ, nervosâ, apice subulato subfoliaceo. *Sepala* ovato-lanceolata, obtusa, trinervia, glumacea; *interiora* 3 parùm longiora. *Stamina* 6, perianthio breviora: *filamenta* complanata, infernè dilatata: *antheræ* oblongæ, obtusæ, biloculares, filamentis triplò breviores: *loculis* parallelis, omninò connatis. *Pistillum* perianthii longitudine: *ovarium* ovatum, acutum, 3-quetrum; *stylus* crassus, ovario duplò brevior: *stigmata* 3, brevia, obtusa, recurvata, crassiuscula, longitudinalitèr papillosa.

This species, although bearing a considerable degree of resemblance to the following, is nevertheless essentially different. The solitary heads of larger flowers, with a short membranous common bracte; the blunt sepals, inclosed stamens, shorter and dilated filaments, and, finally, the shorter style, will readily distinguish it.

4. *J. concinnus*, culmo tereti subdiphyllo, foliis planiusculis obtusis, capitulis 3—6-floris corymbosis, bracteâ communi elongatâ foliaceâ, sepalis acutis capsulâ acutâ longioribus, staminibus longè exsertis, antheris filamentis simplicibus 6-plò brevioribus.

Juncus concinnus. *Don, Prodr. Fl. Nepal. p.* 44.

J. elegans. *Royle MSS.*

Habitat in Nepaliâ (*Wallich*); in Emodi montibus ad Mussooree. *Royle*. ♃. (v. s. sp. in Herbb. Wallich. et Royle.)

Perennis, cæspitosus. *Rhizoma* subbulbosum, fibris capillaceis instructum. *Culmi* rectissimi, filiformes, læves, 1—2-phylli, spithamæi, exsiccatione striati. *Folia* angustè linearia, obtusa, planiuscula, erecta, lævia, suprà canaliculata, subtùs convexiuscula, raró culmum superantia, basi vaginantia: *vaginæ* unciales, membranaceæ, fissæ, culmum arctè involventes. *Capitula* 3 v. 5, rariùs 6 v. 7, terminalia, corymbosa, 3—6-flora. *Flores*

albi, majusculi, brevissimè pedicellati. *Bracteæ partiales* ovato-lanceolatæ, acuminatæ, concavæ, scarioso-membranaceæ, albæ, lævissimæ, floribus vix longiores; *communi* foliaceâ, lineari, obtusâ, canaliculatâ, basi dilatatâ, inflorescentiam duplò superante. *Sepala* lanceolata, acuta, 3-nervia (nervis medio approximatis parallelis), glumacea; *exteriora* 3 parùm minora, subconduplicata, carinata. *Stamina* 6, subæqualia, perianthio triplò longiora: *filamenta* angustè linearia, complanata, alba, basi haud dilatata: *antheræ* lineares, obtusæ, filamentis 6-plò breviores: *loculis* parallelis, omninò connatis. *Pistillum* staminibus multò brevius: *ovarium* ovatum, acutum, triquetrum, nitidum, 3-loculare, perianthio brevius, loculis multiovulatis: *stylus* ovarii longitudine: *stigmata* 3, stylo breviora, obtusa, recurvata, longitudinalitèr papillosa.

I have great satisfaction in presenting a full account of this very distinct and beautiful species, which has been but very imperfectly characterized by me in the work above-quoted.

The many-headed stems, acute sepals, and the great length of the filaments will easily distinguish it from all the other species of this series which it very properly terminates, as it evidently forms the transition to the following section.

The form and direction of the leaves of the species of this group, the higher degree of development of their perianthium, their scobiform seeds having the membranous testa produced beyond the nucleus at both extremities, establish an intimate relationship between *Juncus* and *Narthecium*, as Mr. Brown has long ago suggested, and the passage from the latter genus through *Anthericum* to the *Asphodeleæ* is rendered very clear.

** *Stamina* 3 v. 6. *Semina minuta, obovata. Folia cylindrica, intùs septulis interrupta, hinc nodoso-articulata. Inflorescentia terminalis, capitata, paniculata.*

5. J. acutiflorus. *Ehrh.*

Habitat in regione transhimalensi ad Purbunni. *Inglis.* ♃. (v. s. sp. in Herb. Royle.)

The specimen, which was collected by Mr. Inglis in Purbunni, a district situate beyond the Himalayas, differs in no respect from British ones; and it

affords another example of the extended distribution of the species of this genus.

6. *J. indicus*, triandrus; capitulis multifloris squarrosis trichotomè cymosis, sepalis lineari-lanceolatis apice mucronatis recurvis capsulæ muticæ longitudine, stigmatibus subsessilibus, caule foliisque compressis nodosis.

Juncus indicus. *Royle MSS.*

β. *nanus*, caule 2—3-pollicari, capitulis paucis (1—4).

Habitat α. in Nepaliâ ad Katmandu (*Wallich*); β. in Emodi montibus ad Mussooree. *Royle*. ♃. (v. s. sp. in Herbb. Wallich. et Royle.)

Radix fibrosa, perennis? *Caules* erecti, nodosi, compressi, solidi, spithamæi v. pedales et ultrà, nunc basi reclinati. *Folia* subulata, mucronata, compressa, viridia, intùs septulis interrupta, hinc tactu nodoso-articulata, 2—5-uncialia, basi dilatatâ vaginanti, margine scarioso-membranaceâ. *Flores* sessiles, capitati, virides. *Capitula* squarrosa, multiflora, trichotomè ramosissimèque cymosa. *Bracteæ* lanceolatæ, mucronatæ, floribus breviores, margine scariosæ, hinc carinatæ, indè concavæ. *Sepala* lineari-lanceolata, rigida, apice mucronata, subrecurvata, margine scarioso albo; *exteriora* 3 subcarinata; *interiora* 3 planiuscula, vix breviora. *Stamina* 3, sepalis exterioribus opposita, iisdemque ter breviora: *filamenta* alba, basi dilatata, supernè tenuissimè attenuata: *antheræ* lineares, obtusæ, luteæ, filamentis breviores: *loculis* parallelis, omninò connatis. *Pistillum* stamina superans: *ovarium* conico-oblongum, triquetrum: *stylus* vix ullus: *stigmata* 3, filiformia, revoluta, longitudinalitèr papillosa. *Capsula* oblonga, angusta, perianthium vix excedens, triquetra, 3-locularis, 3-valvis, polysperma, fusca, nitida. *Semina* minuta, ovoidea, gilva, hilo muconiformi et chalazâ brunneis aucta.

This species belongs to the same group as *acutiflorus*, *lampocarpus*, *obtusiflorus*, and others, in which the leaves are cylindrical, divided internally by septa, the inflorescence terminal, and the flowers frequently triandrous. The present plant evidently comes near to the *polycephalus* of Michaux, a native of North America, but it appears to be sufficiently distinguished by its rigid mucronate recurved sepals, and almost sessile stigmata.

The variety β. differs only in its smaller size, and in having much fewer capitula.

*** *Stamina* 6. *Semina elliptica. Folia plana, canaliculata. Flores terminales solitarii v. cymosi.*

7. J. bufonius. *L.*

Habitat in Indiâ boreali circa Delhi et Saharunpore, in Emodi montibus ad Mussooree, et in Kunawur ad Lippa. *Royle.* ⊙. (v. s. sp. in Herb. Royle.)

This species occurs throughout the northern hemisphere from the arctic circle to the equator, and in every region it seems to present the same variations as to its size and branching that it does with us. I have carefully compared the Indian specimens with English ones, and they appear to be essentially the same.

**** *Stamina* 3 *v.* 6. *Semina obovata. Culmi nudi, continui, intùs medullâ farcti. Folia imperfectè evoluta, tantùm radicalia. Inflorescentia unilateralis.*

8. J. glaucus. *Ehrh.*

Habitat in Emodi montibus ad Mussooree et Choor (*Royle*); ad Purbunni. *Inglis.* ♃. (v. s. sp. in Herb. Royle.)

Common throughout the northern and central parts of Europe, but the species does not appear to occur either in Northern Asia or North America, unless it be what authors have described under the name of *effusus*. The species would seem to be pretty general in the Himalayas, having been gathered on Mussooree, Choor, and other mountains by Dr. Royle, and in Purbunni, a region situate beyond the Himalayas, by Mr. Inglis. I ought to notice, however, that the Indian specimens, on a comparison with the European ones, are found to differ in having a longer capsule and broader sepals.

Gen. II. LUZULA.

1. Luzula spicata. *DC.*

Juncus spicatus. *L.*

β. *Kunawurensis*, sepalis latioribus, capsulâ truncatâ muticâ: valvulis obovatis, seminibus duplò minoribus.

Habitat in Kunawur ad Lippa. *Royle.* ♃. (v. s. sp. in Herb. Royle.)

Herba perennis, cæspitosa, multiceps. *Rhizoma* teres, fuscum, fibris capillaribus infrà, et rudimentis foliorum emarcidorum imbricatis suprà munitum. *Culmi* erecti, filiformes, graciles, glabri, simplicissimi, nudiusculi, foliis 2 v. 3 sparsis tantùm muniti, 3—5-pollicares. *Folia* linearia, mucronulata, ad apicem usque plana, subcanaliculata, recurvato-patentia, præsertim ad marginem parcissimè villosa, basi dilatatâ vaginanti-imbricata, sesqui v. tripollicaria; *adultiora* obtusiuscula, ferè omninò glabra, nisi ad oras vaginarum, ubi villis longis mollibus albis copiosè barbata: *caulina* breviora, angustiora, longè vaginantia. *Panicula* terminalis, spiciformis, densa, ovata, nigricans, nutans, semuncialis. *Bracteæ* lanceolatæ, longè setaceo-acuminatæ, ciliatæ, scarioso-membranaceæ, subhyalinæ, fuscescentes, flores excedentes. *Sepala* ovato-lanceolata, acuminato-aristata, brunnescentia, apice recurvata, margine scarioso, pallidiori, glabro; 3 *interiora* parùm angustiora, breviùsque mucronata; 3 *exteriora* firmiora, dorso carinata. *Stamina* 6. *Antheræ* lineares, obtusæ filamentis simplicibus parùm breviores. *Ovarium* subrotundum. *Stylus* capillaris. *Stigmata* 3, filiformia, recurvato-patula, minutè papillosa, stylo ter longiora. *Capsula* turbinato-subrotunda, trigona, brunnea, nitida, perianthio brevior, unilocularis, 3-valvis, apice truncata, vix mucronulata: *valvulis* obovatis. *Semina* 3, oblonga, spadicea, opaca, hinc convexa, indè raphe prominulâ albicanti, et apice chalazâ dilatatâ convexâ aucta.

This highly interesting plant differs in some points of structure from the typical form of *Luzula spicata*. The sepals are broader, darker-coloured, and more abruptly pointed, the inner series being moreover furnished with a shorter point. The capsule is rounded and somewhat turbinate, with the valves obovate, and terminated by an extremely short, abrupt, obtuse point. The seeds are not above half the size of those of the European plant, and are furnished with a less prominent hilum. The European specimens have the sepals narrower and more attenuated, the inner three with equally long points; the valves of the capsule ovate or elliptical, and terminated by a short sharp point; and the seeds double the size, with a pointed hilum.

The two forms agree so remarkably in habit, that after an attentive comparison I do not think the differences of sufficient importance to merit their being regarded as distinct species.

The *Luzula spicata*, which occurs on the mountains of Scotland and the North of England, at an elevation of from 2000 to 3500 feet above the level of the sea, is met with at higher elevations throughout the central and southern parts of Europe, and abundantly in the polar regions of Europe, Asia, and America, as high as 71 degrees of latitude. It is also found on the chain of the Caucasus in 42° north latitude, being exactly in the same parallel with its most southern limit in Europe, and likewise on the Altai mountains, near the sources of the Irtish in 51° north latitude; and it may probably extend along some portions of the table land intervening between that vast range of mountains and the Himalayas.

The present plant is from Kunawur, in about 31° 33′ north latitude, nearly eleven degrees more to the south than any station previously recorded for *Luzula spicata.*

XX. *Description of the* Lepidosiren annectens. *By* Richard Owen, *Esq., F.R.S. F.L.S. F.G.S., Hunterian Professor in the Royal College of Surgeons, London.*

Read April 2nd, 1839.

THE animal about to be described belongs to a genus founded and referred to the class *Amphibia* by Fitzinger*, for the reception of an allied species discovered by Dr. Natterer in the river Amazon, and of which a brief account has been given by that excellent naturalist in the Annals of the Museum of Vienna† under the name of *Lepidosiren paradoxa*, a new genus of the family of Fish-like or Perennibranchiate Reptiles, with the following characters:

"Corpus anguillæforme totum squamatum. Pedes quatuor, valde distantes, adactyli."

In these and most of the other characteristics detailed in the text of Dr. Natterer the present species closely agrees with the *Lepidosiren paradoxa*; the principal differences occur in the relative proportions of the head, trunk and rudimental filamentary extremities.

The whole length of the *Lepidosiren paradoxa* includes eleven lengths of the head, measured from the end of the mouth to the gill-openings: in the present species the total length of the animal includes little more than six lengths of the head. In the *L. paradoxa* the length of the body anterior to the commencement of the dorsal fin includes four and a half lengths of the head: in the *L. annectens* there are only two lengths of the head before the dorsal fin commences. The length of the anterior extremity is one-twelfth that of the entire body in the *L. paradoxa*: it is only one-sixth of the same length in *L. annectens*. This species is therefore distinguished from the *Lepidosiren paradoxa* by the shorter relative length of the trunk as

* Frorieps Notizen, vol. l. p. 90; and Wiegmann's Archiv., 1837. p. 232.

† "*Lepidosiren paradoxa*, eine neue Gattung, aus der Familie der Fischähnlichen Reptilien, von Johann Natterer, Annalen des Wiener Museums der Naturgeschichte, 1837, ii. p. 165."

compared with the head and the extremities,—a difference which is quite independent of age or growth; and the character, "pedes valde distantes," which Dr. Natterer has founded on the length of the trunk, must be restricted as a specific application to the *Lepidosiren paradoxa*.

Dr. Natterer obtained two specimens of his species; one of these, which measured upwards of three feet in length, was found in a swamp on the left bank of the Amazon, above Villa Nuova; the other, which was nearly two feet long, was taken in a pond near Borba, on the river Madeira, a tributary of the Amazon. The specimen about to be described, though differing apparently from the *L. paradoxa* only in certain proportions of its outward form, is a native of a different continent, and was taken in the river Gambia*. It is a female, with the ovaria well-developed, and measures twelve inches, eight lines in length: its greatest circumference is four inches and a half†. The head commences by an obtuse muzzle, and gradually enlarges in all its dimensions to the gill-openings, which are situated immediately anterior to the base of the pectoral extremities: the length of the head from the snout to the gill-opening is one inch, eleven lines; the trunk, from the pectoral to the ventral filamentary fins, is five inches, five lines. The anus, or rather the cloacal vent, is a small elliptical aperture marked with radiating lines, which is situated three lines behind the ventral filaments, and offers the same peculiarity as does that of the *Lepidosiren paradoxa* in not being situated on the median plane: in the present specimen it was on the right side of a longitudinal fold of integument which occupied the middle line. The distance from the vent to the end of the tail is five inches. The trunk gives a wide elliptical transverse section‡, and maintains a pretty uniform size, slightly decreasing in breadth to the ventral filaments. Beyond these the tail becomes more rapidly compressed, and, after a short distance, diminishes also in vertical dimension, till it ends in a thin point.

A membranous dorsal fin commences at the distance of four inches from

* It was presented to the Royal College of Surgeons, June 1837, by Thomas C. B. Weir, Esq., together with a smaller dried specimen inclosed in indurated clay, baked hard by the sun. Several species of insects, peculiar to the Gambia, or African forms, accompanied these specimens. It is here described and figured by permission of the Museum Committee of the College.

† TAB. XXIII. figs. 1. & 2.

‡ Ib. fig. 3.

the snout, and gradually increasing to the height of five lines, is thus continued into the caudal membranous expansion. This fin is supported by numerous soft, elastic, transparent rays articulated to the extremities of the superior and inferior peripheral spines of the caudal vertebræ: the under part of the caudal fin commences about one inch behind the vent.

The entire body is covered with cycloid scales*, which are relatively larger, but have the same general structure and disposition as in the *Lepidosiren paradoxa*. They present a subcircular form, with a diameter of about three lines; their posterior margin adheres to the strong cuticle, with which they are removed as in other fishes: the anterior margin lies freely in a corresponding groove of the chorion. When viewed with a low magnifying power they present a series of canals, radiating somewhat irregularly from a centre near the posterior edge of the scales, and maintaining a uniform diameter. These canals are united together by cross canals, which do not form regular concentric lines. The meshes formed by this reticulation are small and of a subquadrate form at the anterior part of the scale, but are more elongated in the middle of the scale: they are, again, smaller and shorter at the circumference. With a magnifying power of 150 linear diameters the interspaces of the larger canals are seen to be occupied by a finer network of apparent tubes, and from an angle of each of these spaces a short obtuse process, projecting slightly backwards, is developed on the external surface of the scale: the internal surface is quite smooth. There are three or four faint concentric lines of growth at the circumference of the scale, but this body is evidently one continuous organized whole. The subcuticular tissue of the scale is a kind of dense elastic cartilage, not yielding any gas-bubbles on the application of acid. The scales are continued upon the base of the caudal natatory fold of integument.

The disposition of the mucous pores and ducts upon the head is very similar in the two species of *Lepidosiren*, judging from the figure given by Dr. Natterer. A linear series of mucous pores encircles each eye, and from the posterior angle of this series the lateral line commences. This line extends backwards, nearly parallel with the dorsal line, situated a little more than one-fourth of the vertical diameter of the body from that line, until it nearly

* See the magnified view of one of these scales, TAB. XXVII. fig. 1.

reaches the ventral extremities, where it bends down to midway between the dorsal and ventral margins, and so continues to the end of the tail.

The rudimental filamentary fins, the analogues of the four ordinary extremities in the Vertebrata, permanently represent in the present singular animal the earliest embryonic condition of the pectoral and pelvic members. They are round, filiform, gradually attenuated to an undivided point, resembling tentacles or feelers rather than fins or legs, and doubtless restricted to their tactile functions. Each filiform member is supported by a single-jointed, soft, or cartilaginous ray. The pectoral tentacles* are somewhat shorter and more slender than the ventral ones†; the former are two inches, the latter two inches, four lines in length.

The branchial apertures are narrow vertical slits, four lines in extent.

The eyes appear externally as two small round flat spots, of a lighter colour than the surrounding integument; they are situated seven lines from the end of the snout, and nearly the same distance apart from one another. Each of these simple visual organs measures one line and a half in diameter; it is not defended by any palpebral folds of the skin; the cornea is thin, sufficiently transparent to allow the lens to be visible even in the specimen preserved in spirits. The nostrils are situated at the under part of the upper lip, within the opening of the mouth. They appear as two small perforations leading to blind sacs afterwards to be described‡. The opening of the mouth § is wide, and defended by well-developed fleshy lips. The skin at the angles of the mouth is thinner than at the rest of its circumference, and the upper lip folds over the lower one from the angle to near the fore part of the mouth; here the lips are thick, smooth and rounded; the lower lip is the thickest.

About a line behind the lower lip, between it and the teeth, there project six soft papillose processes, of a triangular form; two of these, which are situated in the middle line, consist of a transverse row of papillæ; the posterior ones are membranous, and the papillæ are confined to their margin and outer surface: they occupy the notches of the broad and strong dental plate.

* TAB. XXIII. fig. 2, *a*.

† Ib. *b*.

‡ In the Siren as well as in the Proteus, Cuvier expressly states, that the nasal cavities communicate with the mouth; and attributes to the ingenious naturalist Oken his attention to this circumstance as a distinguishing character between Fishes and Reptiles.—See Ossemens Fossiles, 8vo., 1837, tom. x. p. 339.

§ TAB. XXVII. fig. 2.

Behind the upper lip there are eight similar papillose processes, four on each side; the mesial placed one line behind, or within the margin of the lip; the outermost three lines from the same part: immediately anterior to the interspace of the two outer lamellæ is the orifice of the nostril, which is elliptical, and one line in the long diameter; the olfactory cavity * itself is three lines in the long diameter, and its closed posterior part is occupied with two rows of small transverse lamellæ, about twenty in a row, divided by a transverse line.

There are two small slender, conical, sharp-pointed and slightly recurved teeth †, which project downwards from the intermaxillary bone, to which they are attached by ligaments; and the alveolar border of both the upper and lower maxillaries is armed with a strong trenchant dental plate ‡ anchylosed to the bone, and divided at the middle line so as to form four distinct pieces, two above and two below; each of these teeth or dental plates is impressed on its outer side with two broad angular notches, extending almost through the whole breadth of the plate, and dividing it into three angular processes §, which, from the direction of the notches, appear to radiate from the inner and posterior angle of the tooth: the two anterior divisions in both the upper and lower jaws are the most produced in the vertical direction, and are pointed so as to be adapted for piercing: the posterior divisions are most extended in breadth, and least in height, and terminate in a sharp trenchant edge; the middle divisions present an intermediate structure. These teeth, in their paucity, relative size and mode of fixation to the maxillæ, resemble those of the Chimæra and some of the extinct cartilaginous fishes, as *Cochliodus* and *Ceratodus*; but they are unlike these in their microscopic structure, and differ from any known dental apparatus in the class of Fishes in the modifications of the working surface which at once adapt them for piercing, cutting and crushing. The strength of the jaws and the size of the muscles which work them are proportionate to the size and formidable character of the maxillary dental plates.

There are no lingual, palatine, pterygoid, vomerine or pharyngeal teeth.

The general colour of the specimen was a mixed tint of dark olive-green and brown, growing lighter towards the belly, with irregular dark spots, as

* TAB. XXVII. fig. 2, e, e'.

† TAB. XXIII. fig. 4, *a*. TAB. XXVII. fig. 2, *a*.

‡ TAB. XXIII. fig. 4, *β*, *γ*. TAB. XXV. fig. 4.

§ TAB. XXVII. fig. 2, *b* & *c*.

big as the largest scales, chiefly confined to the tail: the mucous pores and lines were black.

Such are the general external characters of the *Lepidosiren annectens*, in most of which it agrees with the *Lepidosiren paradoxa*. It is not, however, a whit less paradoxical than its earlier described congener; and it may be truly said, that since the discovery of the *Ornithorhynchus paradoxus* there has not been submitted to naturalists an animal which proves more forcibly than the *Lepidosiren* the necessity of a knowledge of its whole organization, both external and internal, in order to arrive at a correct view of its real nature and affinities.

It was the reluctance to bring before the notice of zoologists an incomplete description of this form, which has prevented my being the original proposer of the genus, having recorded its principal characters as the type of a new genus of abdominal malacopterygious Fishes in the MS. Catalogue of the Museum of the College of Surgeons, in June 1837, under the name of '*Protopterus*,' in reference to the rudimental or embryonic condition of the fins, and with the specific name of *anguilliformis* as indicative of its forming a transition from the abdominal to the apodal orders. The subsequent reception of Dr. Natterer's memoir in February 1838, rendered it necessary to substitute another generic and specific name, since the species described by that enterprising and scientific traveller presented still more eel-like proportions.

The anatomical details which form the subject of the remaining part of the present memoir, while they confirm the propriety of referring the genus *Lepidosiren* to the class of Fishes, lead to more enlarged and juster views of its affinities both to the members of that class and to the higher Vertebrate animals. To the description of these details I now proceed.

Osseous System.*

The skeleton of the *Lepidosiren* is partly cartilaginous, partly bony; the ossified portions are of a green colour, like those of the Gar-pike (*Belone vulgaris*). The bodies of the vertebræ retain the primitive condition of a continuous cylindrical gelatinous chord, with an external ligamentous sheath†, except in the caudal region, where they present a cartilaginous firmness, with

* TAB. XXIII. figs. 4, 5, 6, 7.

† TAB. XXIV. fig. 2, *a*.

imperfect divisions corresponding in number with the upper and lower spines. The neurapophyses, or laminæ protecting the spinal chord, are ossified, as are also the neural spines and the hæmapophyses and hæmal spines* in the caudal region.

The neurapophyses of the atlas are slightly expanded at their lower extremities, and almost meet below the foramen magnum, where they rest upon the anterior pointed extremity of the gelatinous chord; as they ascend, they are bent at an open angle, with the upper ends meeting above the foramen magnum: these extremities are disunited, and a short spine is attached to them by a ligament. The neurapophyses of the second cervical vertebræ have their bases expanded so as to meet below the spinal marrow and above the gelatinous chord; they are disunited above, as are the rest of the neurapophyses†. The basis of these vertebral elements, besides being developed inwards, are expanded in the antero-posterior direction so as almost to touch each other; they become gradually narrower as they approach the caudal region. The neural spines‡ increase in length from the atlas to the fourth vertebra, and are continued of the same length, viz. between four and five lines, to the middle of the caudal region, whence they progressively diminish to the end of the vertebral column. The supernumerary or dermal spines§ are rather shorter than the true vertebral spines, to the upper end of which they are attached by ligaments, as in other fishes. In the caudal region they are expanded and compressed, and give attachment to the horny transparent filaments which support the membrane of the caudal fin: the inferior corresponding appendages‖ of the hæmal spines¶ present a similar form, and, like the upper ones, have the same bony structure and green colour as the ossified parts of the true endo-skeleton. The hæmapophyses** are relatively longer and more slender than the neurapophyses.

The capsule of the anterior extremity of the gelatinous chord is ossified at its inferior and lateral parts, where it forms the base of the cranium; and the bodies of the occipital and posterior and anterior sphenoidal vertebræ are represented by a single elongated sub-triangular plate of bone††. The base

* The explanation of these terms, and of the vertebral elements to which they are applied, will be found in my paper on the *Plesiosaurus macrocephalus*, Geol. Trans., 1838.

† TAB. XXIII. fig. 4, *b. b.* ‡ Ib. *c. c.* § Ib. *d. d.* ‖ Ib. *g.* ¶ Ib. *f.*

** Ib. *e.* †† Ib. *h.* fig. 6; and TAB. XXIV. fig. 2, *c.*

of this plate is turned forwards, the apex expands into an oblique elliptical plate, having a shallow depression, which receives the pointed anterior extremity of the gelatinous chord. The fibrous capsule of the chord is attached to the margin of the basi-occipital depression, and supports the neurapophyses of the atlas, anterior to which are the corresponding elements of the occipital vertebra itself. These exoccipitals* present the form of thin expanded plates, of a subquadrate figure, concave towards the medulla oblongata, which they defend and embrace, their anterior and inferior extremities being extended into the upper part of the capsule of the fibrous chord, as far as the middle line, like the bases of the ordinary neurapophyses: their upper extremities meet above by an extended superior margin. The basi-occipital is notched below the base of each exoccipital, leaving a foramen for the transmission of a large nerve. The limits of the basi-occipital and sphenoid bones are indicated by a transverse groove. The basi-sphenoid sends upwards, near its outer margin, two low longitudinal vertical plates, which give attachment to the cartilaginous alæ of the sphenoid forming the lateral parietes of the cranial cavity†. Between these alæ and the ex-occipital bony plates is interposed on each side the large and thick cartilaginous capsule of the organ of hearing‡, which is extended upwards to the parietal bone, and represents the petrous and squamous elements of the temporal bone. There is no distinct supra-occipital bone or spine, but its place is occupied by the posterior extremity of the parietal§. This is a single symmetrical, lozenge-shaped bone, from the middle line of whose upper surface a longitudinal stout spine is developed, augmenting the surface of attachment of the strong temporal muscles. This spine is continued upon the frontal bone‖ as far as its anterior extremity. Both the parietal and frontal bones are ossified, and were anchylosed together in the larger specimen: the limits of the cranial vertebræ are thus effaced above as they are by the confluence of the occipital and sphenoids below. The anterior part of the frontal is deeply notched on each side. There are no distinct ossified anterior frontals, but the posterior frontals¶ are enormously developed, and extend backwards over the frontal and parietal bones as far as the occiput, forming a second bony shield to the skull, analogous to the osseous plates in the

* Tab. XXIII. fig. 4, *i*.

† These portions are distinguished by dots in Tab. XXIII. fig. 4.

‡ Tab. XXIV. fig. 2, *k*, *k*.

§ Tab. XXIII. figs. 4 & 5, *k*.

‖ Ib. *l*.

¶ Ib. *mm*.

Heterobranchus, or to the ossified temporal fascia in the *Cheloniæ*. These elongated post-frontals are of a triangular form, their narrow and irregular base is anterior, and is connected with the median frontal by a moveable ligamentous joint: a small longitudinal vertical crest or ridge is given off from the under surface.

The analogue of the conjoined nasal and intermaxillary bones* is a strong triangular plate of bone, with its rounded anterior apex forming the anterior extremity of the skull, and supporting at its under surface the two long and sharp intermaxillary teeth. It has a slight vertical movement, by means of its posterior ligamentous connexions, upon the frontal and ascending process of the maxillary bone. The maxillary bones, palatines and pterygoids are represented by a single piece of bone on each side. The dental portion of this bone presents three vertical ridges, with intervening notches, radiating from the posterior part of the mesial symphysis: the ridges are in the shape of compressed wedges, with the apex downwards, and are covered with a continuous dense dental substance with a corresponding cutting edge: an ascending triangular process of the maxillary rises above the two outer dental laminæ; its apex is directed backwards, and is joined by ligament to the frontal and intermaxillary bones: the external angle of the maxillary portion of the bone curves backwards and ends in a free point†. The pterygoid portion of the bone now described is indicated by its fulfilling the usual function of an abutment extended between the palatine portion of the upper jaw and the articular pedicle of the lower jaw: it is expanded and compressed as it extends downwards and outwards to support the inner surface of the articular pedicle, and terminates by a broad truncated margin‡.

The articular surface for the lower jaw presents a more complicated form than is usually observed in either fishes or reptiles: its general contour presents a very regular semicircular convexity, but the surface is sculptured by two parallel grooves with an intervening convex ridge, adapted to a corre-

* Tab. XXIII. fig. 4 & 5, *n n*. This bone may, under another point of view, be regarded as analogous to the rostral prolongation of the anterior part of the cranium in the Sturgeon and other *Chondropterygii*; and the true intermaxillaries may be supposed to be confluent with the maxillary, and enter into the formation of the superior dentigerous arch.

† Tab. XXIII. fig. 5, *β*.

‡ Ib. fig. 4 & 5, *o*.

sponding central groove and lateral ridges in the concave articular surface of the lower jaw. Moreover, this double articular trochlea is not bony but cartilaginous in both the pedicle and the lower jaw. The convex or upper part of the joint forms the termination of an elongated piece of cartilage continued from that which represents the squamo-temporal bone, downwards and forwards, between the expanded end of the pterygoid plate above-described, which forms its internal support, and an elongated plate of bone, which runs parallel with the cartilaginous pedicle and adheres to its outer side. This outer plate of bone may be regarded as a rudimental *os tympanicum**: its inferior extremity is regularly convex, and forms the outer edge of the mandibular articulation: above this part it becomes contracted, and, as it were, twisted, with the posterior edge turned outwards, so as to render its external surface concave; it then again becomes expanded and compressed, as it ascends obliquely backwards and terminates in a rounded edge, which gradually degenerates into cartilage.

Each ramus of the lower jaw is composed of an articular or post-mandibular† and a dentary piece‡, as in most osseous fishes. The articular piece is an elongated compressed bone, concave posteriorly where it forms the outer margin of the articular surface, and extending forwards in a groove on the outer and near the lower part of the dentary piece; it ends in a point near the symphysis. The cartilage, which forms the principal part of the articular concavity, extends forwards on the inner side of the postmandibular bone half-way towards the symphysis. The dentary elements are anchylosed to each other at the symphysis, and each is deeply notched behind for the reception of the apex of the postmandibular bone. Their masticating or upper surface is modified in correspondence with the dental surface of the opposed jaw; three trenchant ridges radiate from the symphysis, the anterior being like that in the upper jaw the shortest and thickest, and with the external angle most pointed and produced, adapted for piercing and tearing; the posterior one is the thinnest, and best fitted for cutting: the two anterior dentary ridges in each ramus of the lower jaw work into the notches between the ridges of the jaw above.

Behind, and nearly parallel with the *os tympanicum*, is placed an elongated slender trihedral bone, pointed at both ends, having a slight sigmoid curva-

* Tab. XXIII. fig. 4, *p*.

† Ib. *q*.

‡ Ib. *r*.

ture, and with the external facet concave: this I regard as the analogue of the preopercular bone*: it gives attachment to the membranous and muscular outer wall of the branchial cavity in which the dermal bones of the operculum are developed in ordinary fishes.

A strong cylindrical and almost straight *styloid* bone† is articulated by a somewhat compressed and expanded upper extremity to the cartilaginous petrous element of the temporal; it extends downwards and forwards, parallel with the *os tympanicum*, and is articulated to the upper part of the expanded posterior extremity of the cerato-hyoid bone‡. The opposite extremity of the hyoid is united by ligament to the corresponding bone of the other side, and thus completes the hyoidean arch: there is no representative, bony or cartilaginous, of the body of the *os hyoides*. The slender cartilaginous arches of the gills are merely attached to and supported by the membrane of the cavity of the mouth.

The *scapular* or pectoral, like the hyoidean arch, is simply composed of a pair of elongated incurved bones, representing the anchylosed scapula and coracoid§, on each side. The coracoids meet below the pericardium, and their inferior extremities are united by strong ligaments; the scapular part, as it bends upwards toward the occipital region of the skull, is expanded, compressed, and concave towards the internal and posterior aspects, where it affords origin to the lateral series of muscles below the lateral line.

The cartilaginous basis of the rudimental pectoral fin or anterior extremity|| is articulated to a very regular cartilaginous cavity at the posterior and near the upper end of the scapular arch. About thirty joints may be counted in the single soft ray which represents the skeleton of the pectoral member.

The ribs ¶ are thirty-six pairs, all simple, slightly curved, slender styles, attached to the lower and lateral part of the fibrous capsule of the gelatinous vertebral chord by an upper obtuse extremity, and pointed at the opposite end, which projects into the intermuscular space, and from which the intermuscular ligament is continued. They are all of nearly the same length, viz. about five lines; the posterior pairs become straighter and incline towards each other: the thirty-seventh pair of corresponding appendages meet at their inferior ex-

* TAB. XXIII. fig. 4 & 5, *s. s.* † Ib. *t.* ‡ Ib. *u.*
§ Ib. *v.* || Ib. fig. 4, *w.* ¶ Ib. *x.* TAB. XXIV. fig. 2, *n. n.*

tremities, and are more elongated, forming the first of the caudal series of vascular arches already described.

The pelvic arch is represented by a single piece of cartilage of a crucial form *; the transverse pieces curve slightly upwards, and we may suppose them to represent the iliac elements of the *os innominatum*: the articular surface for the basis of the posterior extremity is near the anterior part of the cartilage. This support of the rudimental ventral fin consists of a single-jointed soft ray †, similar to that of the anterior extremity, but thicker; about forty joints may be counted in this ray, in many of the larger of which there were ossific deposits.

In reviewing the principal characters above noticed of the skeleton of the *Lepidosiren*, we obtain good evidence of its ichthyic nature. If, indeed, the species had been known only by its skeleton, no one could have hesitated in referring it to the class of Fishes; but in that class it would have offered a most singular and interesting combination of the cartilaginous and osseous types.

The central elements of the vertebral column,—the basis of the skeleton,—exhibit a persistence of its primitive embryonic condition, such as has hitherto been witnessed only in the Sturgeon and Cyclostomous fishes; but the superior arches and the spinous appendages, instead of retaining the cartilaginous state, are converted into the tough elastic fibrous texture characteristic of the skeleton of fishes. The cranium in like manner presents an extremely novel combination of the cartilaginous and bony states both as regards its partial ossification and the condition of the ossified parts. It is only in the higher cartilaginous fishes, *e.g.*, that the maxillary, palatine and pterygoid bones are blended together to form the simple superior dentigerous arch or upper jaw. The composition of the lower jaw corresponds with that which characterises most of the osseous fishes, and is more simple than in the Amphibia. The confluence of the cranial vertebræ reminds one of the condition of the skull in the Siren: but no vestige of a preopercular bone is present in any of the Perennibranchiates. The "sphenoideum basilare" as it exists in the Sturgeon is here seen in its fully ossified state. As the basis of the vertebral column presents a condition analogous to that which characterises the early embryonic periods of

* Tab. XXIII. fig. 4, *y*.

† Ib. *z*.

the higher Vertebrata, so also the extremities retain their simple structure as when they first bud forth, and are devoid of any trace of digital divisions: still the march of development has begun, and we perceive by the numerous joints of the cartilaginous ray, that its direction is towards the ichthyic modification of the great vertebral plan.

*Muscular System**.

The muscles of the trunk of the *Lepidosiren* present all the simplicity and uniformity characteristic of the class of Fishes. They are divided by the lateral line into a dorsal and ventral series, each series consists of narrow subvertical plates of oblique fibres, separated by intermuscular fasciæ which afford on one side attachment to an anterior series, and on the opposite to a posterior series of muscular fibres: these fibres are directed upwards and backwards in the dorsal group, and downwards and backwards in the ventral one: the ventral series occupy the place of the true abdominal muscles which first begin to be developed in the strictly air-breathing Reptiles. The muscles of the mandibular, hyoidean, branchial and scapular arches are represented in TAB. XXIII, and will receive their necessary detailed description in the explanation of the figures in that plate. They resemble in some points the arrangement of the same muscles in the Perennibranchians, and in other points that in the true Fishes; but do not afford any sufficiently characteristic modifications to merit further notice here. It may be also observed, that although the muscles of the trunk are quite fish-like in their disposition, yet that the lower Perennibranchians and the larvæ of the higher Batrachia offer a similar agreement in this part of their organization to the class of Fishes.

Nervous System.

The brain consists of the following principal masses; viz. two elongated, oval, subcompressed cerebral lobes, a single elliptical optic lobe†, a medulla oblongata‡, and a transverse medullary fold continued across the anterior part of the widely open fourth ventricle, representing the cerebellum§. In the angle between the representative of the bigeminal bodies and the interspace of the hemispheres there is a well-developed pineal gland‖: on the inferior sur-

* TAB. XXVII. fig. 3 & 4, *a a*. † Ib. fig. 3, *b*. ‡ Ib. fig. 4, *c*.
§ Ib. fig. 3, *d*. ‖ Ib. fig. 3, *e*.

face of the brain behind the hemispheres is an elongated bilobed tract corresponding to the base of the third ventricle*, and posterior to this a single subspherical corpus mammillare†.

The nerves given off from the brain are the olfactory; the optic, which arise close together from the mesial line, traversing the second basal mass; the fifth pair, which are of very large size; the auditory, and the eighth pair of nerves.

The brain bears a closer resemblance to that of the Perennibranchiate Reptiles than to the brain of any fish which has yet been described. Figures of the brains of the *Menopome*‡ and *Menobranchus*§ are added to the plate in order to illustrate this resemblance, which is very striking as regards the *Menobranchus* on account of the rudimental condition of its cerebellum. In the low development of this part of the brain, and in the large size of the pineal gland, the *Lepidosiren* deviates in a marked degree both from the osseous and cartilaginous fishes.

The olfactory nerves‖ are more than twice the size of the optic; they pass forwards through foramina in the cartilaginous æthmoid, and expand upon the posterior surface of the nasal sacs, the pituitary membrane of which is disposed in two series of short transverse folds, about twenty in each, as before mentioned: these olfactory sacs have no communication with the buccal cavity.

The optic nerves¶ arise close together, as in the Skate, from the mesial line traversing the second basal mass; they do not decussate as in the osseous Fishes. They are remarkably small, in correspondence with the feebly-developed organs of vision. Each eyeball adheres to the skin, with which the flat cornea is on a perfect level: there is a small spherical lens, and a membranous sclerotic: there is no trace of the vascular body called, in osseous Fishes, the choroid gland. The diameter of the eyeball is about one line and a half: it has no special muscles, whence the absence of 3rd, 4th, and 6th cerebral nerves.

The organ of hearing consists of a large labyrinth excavated in a thick cartilaginous case, without other external communication than the foramina for

* TAB. XXVII. fig. 4, *f*.
† Ib. fig. 4, *g*.
‡ Ib. fig. 5.
§ Ib. fig. 6.
‖ Ib. fig. 3 & 4, *h h*.
¶ Ib. fig. 4, *i*.

the transmission of the acoustic nerve*. This nerve divides almost immediately into two branches, one of which is distributed over the sac of the lesser otolithe†, and sends a branch to the semicircular canals; the other is expended upon the sac of the greater otolithe‡. These sacs occupy the inferior part of the vestibule; the smaller one is internal, and about one sixth the size of the outer sac; both are of a spherical form, and are nearly filled with a white chalky substance, which here, as in the Cartilaginous Fishes, represents the hard otolithes of the Osseous Fishes. Above these sacs are three small semicircular canals§. There is not a vestige of tympanic cavity or Eustachian tube.

Of the fifth pair of nerves only the second and third divisions are present‖.

The eighth pair of nerves supplies the branchial apparatus, sends a branch along the pharynx to the alimentary canal and air-sacs, and terminates in a large lateral nerve, which is continued backwards over the heads of the ribs to the middle of the caudal region, where it distributes its terminal branches to the muscles of the natatory membrane.

There is no modification worthy of notice, as bearing on the affinities of the *Lepidosiren*, in the spinal chord or nerves.

Digestive System.

The mouth¶ is of moderate width, and is provided with fleshy lips, behind which are the papillose processes already described, and which are doubtless organs of delicate touch: the dental apparatus consists of the two long, moveable, piercing teeth descending from the intermaxillary bone, and the strong trenchant and crushing dental plates which incase the opposed margins of the upper and lower jaws.

Immediately behind the dental plate of the upper jaw there is a broad process of the palatal membrane beset with minute papillæ**, which it may be allowable, perhaps, to compare with the minute palatal teeth of the Siren, here represented in their uncalcified rudimental state. Behind the lower jaw there is a smooth transverse duplicature of the membrane of the mouth, covering the anterior extremities of the cerato-hyoids: this process is succeeded by a second trilobate, narrow, transverse fold††, minutely papillose and glandular.

* TAB. XXVII. fig. 4, *k*. † Ib. fig. 4, l. ‡ Ib. fig. 4, *m*. § Ib. fig. 3, *n*.
‖ Ib. fig. 4, *o*. ¶ Ib. fig. 2. ** TAB. XXIV. fig. 2, *g*. †† TAB. XXVI. fig. 1, *b*.

Beyond these rudiments of a gustatory organ the membrane of the mouth is smooth, slightly puckered into irregular longitudinal folds, and gradually contracting as it passes along the interspace of the branchial openings to the orifice of the pharynx. This orifice* is much smaller and more suddenly contracted than in Fishes generally, or the Perennibranchiate Reptiles: it is also defended by a semicircular valvular fold†, which closes it from below. The œsophagus‡ is scarcely an inch in length; its lining membrane is puckered longitudinally: about three lines from the pharyngeal orifice, at the lower part of the œsophagus, is the laryngeal fissure§, or the orifice of the *ductus pneumaticus*: the fissure is one line in length, and is pierced in the posterior part of a cartilaginous plate‖, which extends forwards to the base of the valve of the pharyngeal aperture, where it terminates in a rounded edge, a line in breadth: this cartilage or rudimental thyroid is here obviously subservient to the maintenance of the patency of the œsophageal canal anterior to the glottis; and the remarkable fact of the presence of a sensitive epiglottis is perhaps explicable on the principle of its correlation with the above structure.

The œsophagus gradually expands into a pyriform but not wide stomach¶, which both in its form and diameter so nearly resembles the intestine that the limits between the two are outwardly not very easy to define. Both œsophagus and stomach are situated in the same continuous straight line as the rest of the alimentary canal. A slight constriction indicates the pyloric extremity of the stomach. The tunics of the stomach are pretty strong: its lining membrane has a smooth surface, and, in the specimen dissected, it was partly decomposed, apparently by the action of the gastric juice, which is a common occurrence in Fishes. The pylorus opens into the intestine by a circular valvular fold of the mucous membrane**, the margins of which are crenate.

Before describing the rest of the alimentary canal, a few words may be premised on the structure of the abdominal cavity††. This commences about half an inch behind the pectoral filamentary fins, and extends about half an inch beyond the anus. It is separated anteriorly from the pericardiac cavity, as in Fishes and Perennibranchiate Reptiles, by a distinct transverse septum.

* Tab. XXVI. fig. 1, *c*.
† Ib. fig. 1, *d*.
‡ Tab. XXV. fig. 2, *a*.
§ Tab. XXVI. fig. 1, *e*.
‖ Ib. *f*.
¶ Tab. XXV. fig. 2, *b*.
** Ib. *c*.
†† Ib. fig. 1.

Its muscular parietes are very thick, and are formed, not by what are called the 'abdominal muscles' in the higher vertebrates, but by the lateral series of oblique muscular fasciculi. The proper tunic of the abdomen is a strong glistening fibrous membrane*, which is lined by a delicate and transparent serous membrane†. This membrane is reflected over the ovaria‡, which occupy the sides of the abdominal cavity; and over the liver§, stomach, and intestine‖, which are situated between the two ovaria: from the anterior or under part of the intestine the two laminæ of the peritoneum are continued in a straight line, forming a kind of mediastinum¶ to the opposite parietes of the abdomen, which is thus divided into two lateral compartments in the two posterior thirds of its extent: these compartments gradually contract posteriorly into peritoneal canals, which intercommunicate by an oval aperture three lines in length, and have a common external outlet** in front of the anus††, but within the common cloacal sphincter. The common opening of the oviducts‡‡ is behind the anus.

The lungs§§ and kidneys are entirely posterior to the peritoneum.

The intestine is three inches and a half in length, and becomes gradually contracted to the vent; it is traversed throughout by a spiral valve‖‖, which performs six gyrations: the extent of intestine traversed by the first turn is the greatest, measuring above an inch: the second is suddenly shorter, being about four lines in length: the remaining folds gradually diminish to three lines in longitudinal extent. The valve terminates by forming a longitudinal ridge in the narrow rectum¶¶, which measures about an inch in length. The tunics of the intestine are thick and strong, especially the internal one, which presents a glandular structure similar to that in the Sturgeon: its surface is, however, proportionally less strongly honeycombed: it is increased at the beginning of the intestine principally by spiral linear elevations, in the interspaces of which there is a fine reticulation.

There was no pancreas, nor pancreatic cæca; neither could any trace of a spleen be detected.

The liver is a flattened subelongate unilobate gland, situated between the

* TAB. XXIV. fig. 2, *n.n.* † Ib. fig. 2, *m. m.* ‡ TAB. XXV. *g.* § Ib. *h.*
‖ Ib. *k.* ¶ Ib. *l.* ** Ib. *m.* †† Ib. *n.*
‡‡ Ib. *o.* §§ Ib. fig. 3. ‖‖ Ib. fig. 2, *d.* ¶¶ Ib. *e.*

stomach and right ovarium, chiefly in the anterior undivided part of the abdominal cavity, but extending about half an inch beyond the commencement of the peritoneal mediastinum: it is convex externally, and concave towards the alimentary canal, measuring two inches three lines in length, and eight lines in width. It is of a light brown colour, having its peritoneal coat speckled with dark brown spots. The gall-bladder* is lodged in a notch on the anterior surface of the left margin of the liver; it is sunk in the substance of the liver, with part of its surface exposed. The gall-bladder receives the bile by two cyst-hepatic ducts which enter its cervix, and the secretion is carried to the intestine by a single, short, but moderately wide cystic duct†, which terminates close to the pylorus, and by a similar but smaller valvular projection. Most of the veins of the abdominal viscera and of the abdominal parietes contribute to form the vena portæ: the hepatic veins are four or five in number, but there is a principal one‡, which emerges from the anterior part of the liver and forms the vena cava. This great vein, with three other vascular trunks, viz. the aorta, pulmonary artery, and pulmonary vein, penetrate the septum which forms the anterior wall of the abdominal cavity. This septum is formed by the fibrous membrane of the abdomen, which is then continued around the pericardium, to which it is united by a cellular medium: a portion of it is seen reflected in Tab. XXV. fig. 1, *d*. After dissecting away this fibrous tunic the true pericardium § is brought into view: it is protected by the coracoid bones, which meet below it: one of these is seen turned back in fig. 3, *x*. Tab. XXV.; and the pericardium is removed on that side so as to expose the heart.

Circulating and Respiratory Systems.

The heart ‖ consists of a single auricle, a ventricle, and a bulbus arteriosus. The auricle¶ is large, and is applied to the dorsal surface of the ventricle, but sends forward two apices or appendages into the interspace between the ventricle and the bulbus arteriosus; one on the right, the other on the left side. The vena cava** terminates in the right side of the auricle; it is joined by two superior cavæ and by the single large pulmonary vein: this vein††

* Tab. XXV. fig. 2, *g*.
† Ib. fig. 2, *h*.
‡ Ib. *i*.
§ Tab. XXV. fig. 1 & 3, *e*.
‖ Tab. XXV. fig. 3, *a* & *b*.
¶ Tab. XXVI. fig. 2, *a*.
** Ib. fig. 2, *e*.
†† Ib. fig. 2, *f*.

does not, however, communicate with the sinus, but passes along entire and adherent to the inner surface of the vena cava as far as the auriculo-ventricular aperture, where it empties its contents into the ventricle by a distinct orifice, protected by a cartilaginous valvular tubercle. It needed only that the pulmonary vein should have been dilated *before its termination* in order to have established a biauricular structure of the heart, as in the Siren. The same functional advantage is, however, thus secured to the *Lepidosiren*, with a maintenance of the simple dicœlous type of the heart of the Fish: the continuation of the pulmonary vein preventing the admixture of the respired with the venous blood, until both have arrived in the ventricle.

The ventricle* is of an elongated form, truncate anteriorly where it is in contact with the bulbus arteriosus, and with an obtuse rounded apex at the opposite end: it is four lines in length, and two in breadth. The cavity of the ventricle is extremely small; its parietes are thick and reticularly muscular: a small round orifice leads into the bulbus arteriosus. This body† presents externally a simple transversely oval form; but its internal structure is more complicated than would be suspected from its external appearance. It is formed by a short spiral turn of the dilated aorta, which is concealed under a simple continuous outer fibrous coat: the area of this part of the vessel is almost entirely occupied by two continuous valvular projections, or their processes, which are attached by one edge to the internal surface of the aorta, and have the opposite margin projecting freely into the arterial cavity. If these internal valves were straight, they would resemble the single thicker valvular process which occupies the elongated bulbus arteriosus of the Siren: here, however, they follow the spiral turn of the aorta.

The aorta‡ in the present most remarkable species fulfils at once the office of a systemic, a branchial, and a pulmonary artery: it distributes on each side six vessels corresponding to the six branchial cartilaginous arches. The mucous membrane is produced into a branchial fringe on the convex side of the 1st, 4th, 5th, and 6th branchial arches, and the corresponding arteries are minutely subdivided before they are continued to the dorsal side of the pharynx: these four pairs of vessels are therefore true or functional branchial arteries. The mucous membrane merely invests with a simple fold the second

* TAB. XXVI. fig. 2, *b*. † Ib. fig. 2, *c*. ‡ Ib. fig. 2, *g*.

and third branchial arches; and the corresponding arterial trunks* undergo no subdivision as they wind round them, but are continued entire, as in the Amphiuma and Menopoma, to their termination at the opposite side of the vascular circle. The branches which afterwards unite to form the single pulmonary artery on each side are given off from near the termination of the second and third pairs of the primitive aortic trunk; which thus combine the functions of both systemic and pulmonary arteries.

The branchiæ of the *Lepidosiren* resemble in form those of the Siren, consisting of separate elongated filaments, attached only by one extremity to the branchial arch; but these extremities are fixed directly to the branchial arch, and not to a common pedicle extended therefrom, as in the Siren. Viewed with a moderate lens the tripinnatifid structure is beautifully seen in each branchial filament. The first gill† consists of a single row of fourteen of these subcompressed filaments, each of which is about one line in length and a third of a line in breadth. The second gill‡, which is developed, as before stated, on the fourth branchial arch, is the largest, and consists of a double row of fifteen branchial filaments. The third gill§ has a similar structure. The fourth gill‖ consists, like the first, of a single row of fourteen tripinnatifid filaments, which are shorter and smaller than those of the first.

The cartilaginous branchial arches are developed on each side in the submucous tissue, and, as before stated, are not attached either to the hyoid apparatus below, or to the cranium above. The membrane covering the 3rd, 4th, and 5th arches is minutely papillose. The first branchial aperture or interspace¶ is a narrow slit three lines long, and is defended by a series of minute denticulations projecting from the branchial arch. Bristles are represented as passing through the five branchial interspaces in TAB. XXV. fig. 3. The second aperture** is the widest; it is five lines long, and its margins are smooth: the third aperture is also five lines long, but is narrower than the second: small cartilaginous teeth are developed from each of its margins, as in the first gill-aperture: the fourth and fifth apertures present the same structure but diminish in size.

Thus the branchial current, which flows through the interspaces of those

* TAB. XXVI. fig. 2, 2 & 3.
† Ib. fig. 2, 1.
‡ Ib. fig. 2, 4.
§ Ib. fig. 2, 5.
‖ Ib. fig. 2, 6.
¶ Ib. fig. 1, 1.
** Ib. fig. 1, 2.

arches which support the gills, is subject to a previous filtration by the interlocking marginal denticles; while that which flows between those two branchial arches from which no gills are developed has a free and uninterrupted passage.

The gills do not form any external projection, as in the gill-bearing Perennibranchians, but are contained in a moderately capacious branchial chamber, the parietes of which are formed by a mucous and muscular stratum*; the external outlet is the vertical slit already described, situated immediately anterior to the filamentary pectoral member.

Thus although the organs for respiration through the medium of water correspond in all essential points with those of the true Fishes, yet the gills approximate in their filamentary form to those of the Perennibranchiate Reptiles. And, again, although the gills are four in number on each side, as in the Osseous Fishes, yet the number of branchial apertures and arches corresponds with that which characterizes the higher Cartilaginous Fishes. So that while we perceive, even in the organs for breathing water, a tendency towards the amphibious type, we find at the same time that the branchial as well as the osseous system manifests a most interesting and hitherto unexampled transitional structure between the Plagiostomous and Osseous Fishes.

We have next to consider that part of the Respiratory System which is organized for breathing immediately the atmospheric air, or the Lungs†: for I know not how otherwise to designate, according either to their physiological or morphological relations, those organs, which in the technical language of the ichthyologist would be termed the swim- or air-bladder.

The *trachea*‡, or, to use the same technical and partial nomenclature, the 'ductus pneumaticus,' is a short wide membranous tube, as in the Perennibranchiate Reptiles. The glottis§ opens near the posterior part of a long rudimental thyroid cartilage; a few lines posterior to the *isthmus faucium* the opposite end of the trachea dilates into a membranous sac which communicates by two large lateral apertures with the lungs. These are widest at their anterior extremities, and gradually decrease in diameter to the cloaca, behind which they terminate each in an obtuse point. They are lodged in the dorsal angle of the abdominal cavity behind the kidneys, and are attached

* Tab. XXVI. fig. 2, *h*. † Tab. XXV. fig. 3, *i, i*. ‡ Tab. XXVI. fig. 1, *k*.
§ Ib. fig. 1, *e*.

by cellular tissue to all the surrounding parts, and particularly to the ribs, of which they bear the impressions on their posterior surface. The anterior part of each lung is divided into four or five small lobes, of which the first is about half an inch long, of a triangular form, with the apex forming the most anterior part of the lung: the other lobes decrease in size, and at the distance of one inch and a half from the anterior end, the lung takes on the form of a simple compressed bag, and so continues to its posterior extremity. The parietes of the lung present a moderate thickness throughout, and the whole of the internal surface is cellular, the cells having the same proportional size and form as in the respiratory part of the lung of a serpent. The cells are largest and most subdivided at the anterior fourth part of the lung; the livid colour of which in the specimen dissected by me attested the great natural vascularity of the part.

The pulmonary artery*, formed by the union of the branches from the second and third branchial arteries, descends between the vena cava† in front and the left branch of the vena pulmonalis‡ behind, to the interspace of the lungs; here it distributes branches to the anterior lobes, and then divides: each division§ extends along the mesial side of its corresponding lung to the extremity. The blood distributed by the capillaries of this artery over the cells of the lung is collected into a vein‖ which returns along the lateral or outer margin of the lung as far as the commencement of the lobulated part; here it crosses obliquely the anterior surface of the lung, and unites with its fellow at the beginning of the interspace of the lungs: the common pulmonary vein runs parallel with and behind the vena cava for a few lines; then obliquely pierces the pericardium and enters the sinus formed by the expansion of the vena cava, and continues attached to the parietes of that sinus till it reaches the auriculo-ventricular aperture, where it terminates, close behind the singular cartilaginous knob before-mentioned.

Renal System.

The kidneys¶ are narrow bodies, three inches in length, and about two lines in diameter at their widest part, which is near the cloaca; from this extremity they gradually contract, as they pass forwards, to a fine point. They are

* TAB. XXVI. fig. 2, *l*. † Ib. *e*. ‡ Ib. *f*. § Ib. *m*. ‖ Ib. *n*, *n*.
¶ TAB. XXVII. fig. 7, *h*, *h*.

three-sided, with their broadest flattened surface turned forwards and covered by the peritoneum. The ureter* runs along their posterior and outer edge, and opens into the common termination of the oviducts. The kidneys are surrounded by a capsule of cellular membrane, beneath which there is a quantity of intense black pigment: the same pigment is developed from the membrane surrounding the oviducts above the kidneys. There is a small Allantoid bladder†.

Generative System.

The ovaria‡ are compressed bodies between four and five inches in length, situated, as above described, at the sides of the abdominal cavity; having a proper capsule beneath the serous investment, and with their posterior extremities continued a little way beyond the posterior line of reflection of the peritoneum. The ovisacs exhibited different stages of development: those on the posterior part of the ovarium were larger than those on the anterior. The larger ova are from one line to two lines in diameter; these were scattered throughout the whole length of ovary, and were separated by clusters of smaller ovisacs varying in size from one twentieth of an inch to invisible minuteness. The oviducts§ are long, tortuous, and commence each by a distinct aperture at their anterior part, which is in the form of a slit, about three lines in length‖. The oviduct is closely attached throughout the greater part of its course to the outside of the capsula ovarii: its tunics gradually increase in thickness as it approaches the cloaca, but are nowhere complicated with a special glandular apparatus. The internal surface of the lower third of the oviduct presents small parallel oblique laminæ, like those in the uterus of the Shark. The two oviducts unite and form one strong muscular canal between the allantois and the ureters; and after receiving the contents of these parts, the common canal terminates in the posterior part of the cloaca.

Thus the female organs of generation in the *Lepidosiren*, both as regards the condition of the ovaria, caused by the partial or successive development of the ova, and the freedom of the oviduct, present a grade of development as high as that which characterizes the Plagiostomous Fishes; while the elongated

* TAB. XXVII. fig. 7, *i*. † *Ib*. *k*. ‡ TAB. XXV. fig. 1. *g*.; and TAB. XXVII. fig. 7, *l*, *l*.
§ TAB. XXVII. fig 7, *m*, *m*. ‖ *Ib*. *n*, *n*.

form of the ovaria and the convoluted disposition of the oviduct resemble more the same parts in the Axolotl, Amphiuma and Siren.

Concluding Observations.

Most naturalists have considered the Vertebrate animals to form four distinct classes, characterized by as many leading modifications of the respiratory organs; Mammals, *e. g.*, being distinguished by having lungs composed throughout of a dense spongy texture, and suspended freely in a thoracic cavity; Birds, by having spongy lungs firmly adherent to the posterior parietes of the thorax, and generally communicating with air-cells continued into the abdomen and other parts of the body; Reptiles, by membranous lungs extending into the abdominal cavity; and Fishes, by breathing with gills alone.

It is true, that the limits which separated the two classes of cold-blooded Vertebrates were overpassed by the Batrachian Reptiles, which possess gills during either a part or the whole of their existence; but as lungs of the Reptilian type coexisted with these gills in the mature animal, these have been always separated from Fishes, either as an order of Reptiles, or as a distinct class, under the name of *Amphibia*. Their air-breathing organs were, in fact, regarded as such essential indications of their superiority to Fishes, that when the heart of the Batrachia was believed to be dicœlous, and before it had been demonstrated that the most fish-like of the Amphibia, as the Siren, had a double auricle, they were equally regarded either as a class or sub-class of Reptiles.

In the *Lepidosiren*, however, we have a cold-blooded vertebrate animal, of which I may say in the very words of Cuvier when speaking of the Siren, "J'ai sous les yeux les poumons ou l'appareil vasculaire est aussi développé et aussi compliqué que dans aucune reptile." Nevertheless we cannot call it strictly and zoologically a Batrachian; not, however, because the heart has one instead of two auricles, for one, at least, of the Amphibia (the Proteus) possesses a single undivided auricle: and were even the 'septum auricularum' absent in the Salamander or Frog, these would not, therefore, be Fishes.

Neither can we call the *Lepidosiren* a Fish, simply on account of its having branchial arches and gills, inclosed in a branchial chamber, with a single

opercular outlet; because the larva of the tailless Batrachian presents at one period of its existence a similar structure; yet if that state were persistent instead of transitory, it would still be a Reptile and not a Fish. It cannot therefore be determined by the modifications of the respiratory organs whether the *Lepidosiren* be a Fish or a Reptile. Can it be proved to be a Fish by the modifications of its digestive system? A straight intestine with an internal spiral valve has hitherto been met with only in the class of Fishes; yet it occurs rather as an exceptional than a general structure in that class. Supposing that a spiral intestinal valve had been discovered in the *Amphiuma*, *Siren*, or *Proteus*, should we have been justified on that ground in removing such species to the class of Fishes? There is good evidence that the intestine of the *Ichthyosaurus* was provided with a spiral valve, yet it is not on that account regarded as a Fish. If I mistake not, indeed, the intestinal spiral valve of higher *Chondropterygii* is a structure dependent on a slight modification only of that peculiar disposition of the intestinal canal which characterizes the gill-breathing larvæ of the *Batrachia*: we have but to inclose the series of spiral coils of gut of the tadpole in a common investing membrane, so as to conceal the complication under a simple exterior, and little more is wanting to render the conversion of the one into the other structure complete.

In reviewing the peculiarities of the osseous system with reference to the affinities of the *Lepidosiren*, it may first be remarked, that no Amphibian has hitherto presented an unossified condition of the bodies of its vertebræ, or of the parts of the skull containing the organ of hearing. Would such osteological modifications, it may be asked, have sufficed to alter our opinion of the classific relations of the *Siren*? Such a condition of the skeleton, it may be answered, is by no means characteristic of the class of Fishes. If any general ichthyic character can be taken from the skeleton, it is the reciprocal union of the bodies of the vertebræ by opposite concave facets. Now the Perennibranchiate *Batrachia* do in fact present this very structure; yet they have not, any more than the *Ichthyosauri*, been transferred to the class of Fishes on that account: we may conclude, therefore, that their position in zoological classifications would not have been changed, even if their skeleton had resembled that of the *Lepidosiren*. It is only in a few fishes that the bones are green; neither in the scaly nor naked reptiles has the skeleton been found to

present this colour: yet it is almost superfluous to remark that so trivial a character would of itself have been totally inadequate to determine the classific characters of a doubtful species: it is only in conjunction with other modifications of structure that it assists in our present attempt to determine the true affinities of the *Lepidosiren.*

As regards the principal conditions of the organs of generation, the line of demarcation cannot be drawn between the *Amphibia* and the Plagiostomous *Chondropterygii*: and the structure of these organs in the *Lepidosiren,* while it shows its near affinity to the Reptiles, by no means proves that it is not a Fish.

The brain of the *Lepidosiren* like its generative system indicates its close relationship as a Fish with the *Amphibia,* but nothing more.

The optic nerves do not decussate, but come off from nearly the same point in front of the infundibulum: since, however, the same structure exists in the Sharks and Rays, this likewise fails to establish the amphibious character of the *Lepidosiren.*

On the other hand, the simple condition of the organ of hearing, consisting merely of the labyrinth without a cochlea, or a fenestra rotunda, might be taken as proof of the ichthyic nature of the *Lepidosiren*: the organ of hearing, however, presents, as is well known, a similar simple condition in the Perennibranchiate Reptiles.

In the organ of smell we have, at last, a character which is absolute in reference to the distinction of Fishes from Reptiles. In every Fish it is a shut sac communicating only with the external surface; in every Reptile it is a canal with both an external and an internal opening.

According to this test, the *Lepidosiren* is a Fish: by its nose it is known not to be a Reptile: in other words, it may be said that the *Lepidosiren* is proved to be a Fish, not by its gills, not by its air-bladders, not by its spiral intestine, not by its unossified skeleton, not by its generative apparatus, nor its extremities, nor its skin, nor its eyes, nor its ears, but simply by its nose; so that at the close of our analysis we arrive at this very unexpected result, that a Reptile is not characterized by its lungs nor a Fish by its gills, but that the only unexceptionable distinction is afforded by the organ of smell.

The anatomical facts already detailed fully justify this emphatic summary of the evidence deducible from the dissection of the *Lepidosiren*; yet it must

be confessed that the physiological consequences of the modifications of the nasal cavity above alluded to would have been far too insignificant to have established the ichthyic nature of the *Lepidosiren*, if, with coexisting gills and lungs, the modifications of the other organic systems had agreed with those of the Perennibranchians instead of with those of Fishes. For although it be true that the fish-like modification of any single system is insufficient of itself to determine the removal of the *Lepidosiren* from the *Amphibia*, in which it has hitherto been placed, to the class of Fishes, yet it is impossible to avoid arriving at that conclusion, when we consider the concurrence of ichthyic characters in so many parts of the organization of this most interesting species. The combination of cycloid scales, mucous ducts, quasi-fins supported each by a many-jointed ray, a gelatino-cartilaginous vertebral style united to the whole surface of the basi-occipital and not to two basilar condyles, the præopercular bone, the simple structure of the lower jaw, the double spines of the neur- and hæm-apophyses, the green colour of the ossified parts of the skeleton ;—these external and osteological characters being associated with an intestinal spiral valve, with the absence of pancreas and spleen, the position of the anus anterior to the allantoid bladder, a dicœlous heart, six pairs of branchial arches with the gills concealed, the simple organ of hearing consisting only of the acoustic labyrinth excavated in cartilage and provided with large otolithes, and, lastly, the blind nasal sacs,—form a cumulative body of evidence in proof that the *Lepidosiren* is a Fish, which far outweighs the argument to the contrary, founded on the reptile-like development of its air-bladder, and its conversion into an organ of aërial respiration.

The weight of this argument is, in fact, very much diminished by the close approximation which certain of the abdominal Fishes, called 'Sauroid' by M. Agassiz, make to the *Lepidosiren* in the lung-like structure of the air-bladder. In the Freshwater *Amia* Cuvier states that its swim-bladder is as cellular as the lung of a Reptile* : and this genus also agrees with the *Lepidosiren* in the absence of pyloric cæcal appendages. In the genus *Lepidosteus*, again, Cuvier describes the air-bladder as being as cellular as in the *Amia*, and occupying the whole length of the abdomen†.

* "La vessie natatoire est celluleuse comme un poumon de Reptile." *Règne Anim.* ii. p. 327.

† Loc. cit. p. 329.

M. Agassiz has confirmed this statement, and further observes, that the ductus pneumaticus communicates with the pharynx by a large and regular slit, which he regards "as bearing even a closer resemblance to the entrance of the trachea of the Pulmoniferous *Vertebrata* in general, than the aperture by means of which the lungs communicate with the pharynx in the Perennibranchiate *Amphibia**." In the *Polypterus*, lastly, we find an approach to the *Lepidosiren* in the air-bladder being double, consisting of two long cylindrical lobes, but of unequal length, the left being the longest, and extending through the whole length of the abdomen: the communication of the trachea, or ductus pneumaticus, with the œsophagus, is also here described by Geoffroy St. Hilaire as consisting of a fissure provided with a constrictor muscle.

The *Polypterus*, moreover, presents a most interesting trait of affinity to the *Lepidosiren* in the shortness and straightness of its intestinal canal, which is provided with an internal spiral valve.

With these advances in the organization of the air-bladder in certain abdominal Fishes towards the reptilian structure of the lung, made by the *Amia* and *Lepidosteus* on the one part, in the cellular complication of a single cylindrical air-bladder; and by the *Polypterus*, on the other hand, in the division of the air-bladder into two lobes, with the slit-shaped glottis of the ductus pneumaticus described by Geoffroy and Agassiz; there wanted only the combination of the three characters, as it occurs in the *Lepidosiren*, of a double as well as cellular air-bladder, with a rudimental larynx, to dissipate the last doubts entertained by the stanchest realist as to the true homology, long ago pointed out by Harvey and Hunter, of the vesica natatoria and ductus pneumaticus of the ichthyologist.

Having indicated some of the affinities of the *Lepidosiren*, considered as a Fish, to certain species of the Sauroid family, I may further observe, that in the helmet-like plate into which a part of the frontal is developed, we perceive a resemblance to the genus *Heterobranchus* amongst the Siluroid family of abdominal soft-finned Fishes, most of the species of which also possess a bilobed air-bladder communicating with the œsophagus, and are deficient in pancreatic cæca.

When we consider also that the *Esocidæ* have all a large air-bladder, and

* Zoological Proceedings, 1834, p. 119.

want the pancreatic cæca, the analogy which *Lepidosiren* offers to one genus in that group, *Belone*, in the elongated slender form of the body and its green bones, is not without interest.

In the low condition to which the pectoral and ventral fins are reduced, the zoologist who deals merely with external characters would see in the *Lepidosiren* a transitional form between the abdominal and apodal groups of the *Malacopterygii*. But by far the most important affinities which a deeper research into the organization of the *Lepidosiren* brings to light, are those to the higher Cartilaginous Fishes which are indicated by the semiossified condition of its skeleton; by the removal of the acoustic labyrinth from the cavity into the parietes of the skull; by the number of branchial arches; by the simplicity of the maxillary apparatus; by the spiral intestinal valve; and, above all, by the condition of the oviducts as distinct tubes with two separate apertures.

From every group of Fishes, however, the *Lepidosiren* is sufficiently distinct to form the type not merely of a genus, but of a family; and, in the natural system, it forms a link connecting the higher Cartilaginous Fishes with the Sauroid genera *Polypterus* and *Lepidosteus*; and at the same time makes the nearest approach in the class of Fishes to the Perennibranchiate Reptiles.

EXPLANATION OF THE PLATES.

TAB. XXIII.

External Form and Skeleton of the *Lepidosiren annectens*, on the scale of 8 inches to a foot.

Fig. 1. Side view of *Lepidosiren annectens*.

2. Upper view of the same, in outline.

   a. Filamentary anterior extremities, or pectoral fins.

   b. ———— posterior extremities, or ventral fins.

3. Transverse section of the same, one inch in advance of the ventral filaments.

Fig. 4. Side view of the skeleton of *Lepidosiren annectens.*

a. Cartilaginous vertebral style, or ' chorda dorsalis," representing the bodies of the vertebræ.

b. Superior laminæ, or neurapophyses of the vertebræ.

c. Neurapophysial spines.

d. Dermal neurapophysial spines.

e. Inferior arches, or hæmapophyses of the caudal vertebræ.

f. Hæmapophysial spines.

g. Dermal hæmapophysial spines.

h. Basi-occipito-sphænoidal bone.

i. Ex-occipital bone.

k. Parietal bone.

l. Frontal bone.

m. Posterior frontal bone.

n. Intermaxillary bone.

o. Maxillo-pterygoïdian bone.

p. Tympanic hone.

q. Articular, and *r.* dentary, elements of the inferior maxillary bone.

s. Pre-opercular bone.

t. Stylo-hyoid bone.

u. Cerato-hyoid bone.

v. Scapulo-coracoid bone.

w. Jointed cartilaginous ray of pectoral fin.

x. Ribs.

y. Pelvic cartilage.

z. Jointed cartilaginous ray of ventral fin.

α. Intermaxillary teeth.

β. Dental plate of upper jaw.

γ. Dental plate of lower jaw.

5. Upper surface of the skull.

6. Superior or internal surface of the basi-occipito-sphenoidal bone; natural size.

7. Inferior surface of the lower jaw; two thirds natural size.

TAB. XXIV.

Muscular System of the *Lepidosiren annectens.*

Fig. 1. *a.* Dorso-lateral series of muscles.

b. Ventro-lateral series of muscles.

c. Levatores pinnæ caudalis superiores.

d. Levatores pinnæ caudalis inferiores.

e. Levator scapulæ.

f. Retractor scapulæ.

g. Temporalis.

h. Biventer, seu apertor oris.

i. Mylohyoideus, seu constrictor branchiarum.

The temporalis is an extremely powerful muscle, arising from the whole lateral part of the fronto-parietal bone, the median crest of which is developed for the purpose of increasing the surface of attachment, and consequently the bulk of the principal closer of the jaws. Small muscles pass from the ascending process of the upper maxillary to the under surface of the single intermaxillary bone, which they depress, and thereby serve to infix the sharp and slender intermaxillary teeth in the prey of the *Lepidosiren.* The analogue of the *biventer maxillæ* is a penniform muscle, and takes its origin from the upper and outer surface of the tympanic bone: it is inserted into the outer part of the lower jaw near the angle, and opens the mouth. Small choanoid muscles are attached to the base of the cartilage of each filamentary fin.

2. *a. a.* Fibro-gelatinous 'chorda dorsalis'. *b.* A portion of the central gelatinous part removed, leaving the fibrous capsule to which the ribs *r. r.* are attached.

c. Bone representing the anchylosed anterior and posterior basi-sphenoid and basi-occipital bones.

d. Pterygoid abutment, which is here a process of the superior maxillary arch.

e. Cartilaginous pedicle and joint of the lower jaw, strengthened externally by the tympanic bone.

f. Fibrous membrane filling the interspace of the pterygoids and forming the roof of the mouth.

g. Papillose mucous membrane of the palate.

h. Maxillary dental plate.

i. Intermaxillary teeth.

k. k. Cartilaginous representatives of the 'ossa petrosa,' containing the organ of hearing.

l. l. Internal stratum of muscular fibres (*intercostales*), commencing between the ribs, and continued over the upper or dorsal two thirds of the abdominal cavity. A portion (at the interspace of the letters) is dissected away to show the inner surface of the external muscular stratum.

m. m. Serous layer of the peritoneum: the letters on the right side show the line of reflection of this layer from

n. n. The glistening fibrous membrane of the abdominal cavity.

Fig. 3. The lower jaw, seen from behind, showing the trochlear cavities, *o. o.*, which are adapted to the convexities, *e. e.* fig. 2.

4. Under surface of the head of the *Lepidosiren*, showing the largely-developed *mylo-hyoideus*, *a.*, which is first exposed when the skin is dissected away: it arises not only from the rami of the jaw, but from the whole length of the preopercular bone, and is inserted with its fellow in a median raphé: it compresses the branchial cavity.

5. In this figure the preceding muscle is reflected to expose *b.* the retractor of the os hyoides, which is at the same time, through the attachment of the *genio-hyoideus*, *c*, a retractor and depressor of the lower jaw. This powerful muscle takes its origin from the median aponeurosis representing the sternum, and may be regarded as the homologue of the sterno-hyoideus: by retracting the os hyoides it dilates the branchial cavity, and is thus the principal muscle of aquatic inspiration.

6. Shows the muscles, *d. d.*, which are exposed by the reflection of the preceding ones: they are very thick, connect the hyoid with the coracoid arch, and both with the great ventro-lateral series of muscles.

TAB. XXV.

Fig. 1. Abdominal cavity and pericardium of *Lepidosiren annectens.*

a. Mylo-hyoideus. b. Sterno-hyoideus. c. Coraco-hyoideus. d. Fibrous membrane covering the pericardium *e. f.* Serous layer of the peritoneum reflected from the pericardiac septum. *g.* Right ovarium. *h.* Liver. *i.* Gall-bladder. *k.* Intestine. *l.* Mediastinal fold of the serous layer of the peritoneum. *m.* A bristle passed through the peritoneal outlet. *n.* The same through the anal orifice. *o.* The same through the uro-genital outlet. (The common cloacal passage is removed with the skin.)

2. Digestive organs of *Lepidosiren annectens.*

a. Œsophagus. *b.* Stomach, laid open. *c.* Pyloric valve. *d.* Spiral valve of intestine. *e.* Rectum. *f.* Liver. *g.* Gall-bladder. *h.* Valvular termination of *ductus choledochus. i. Vena cava hepatica.*

3. Heart, gills, and lungs *in situ*, of *Lepidosiren annectens.*

a. Auricle; the letter is placed on the right appendix. *b.* Ventricle. *c. Bulbus arteriosus. d.* The pericardium. *e.* The abdominal vena cava. *f.* The muscular stratum dissected off, to show *g.* the mucous membrane of the branchial chamber of the right side. Both are removed on the left side, to expose the gills and branchial arches: bristles are represented as passing from the mouth through the five interspaces of the branchial arches. *h.* The hyoid arch. *i. i.* The lungs: that on the right side is laid open to show its cellular structure. *x.* The left coracoid turned outwards, to show the heart: the right coracoid is *in situ,* with the pericardium attached to it.

4. Front view of the jaws and teeth of *Lepidosiren annectens.*

5. View of the upper or working surface of the dental plates of the lower jaw.

All the figures in this plate are of the natural size.

Tab. XXVI.

Circulating and Respiratory Organs of the *Lepidosiren annectens*, on the scale of one inch to half an inch.

Fig. 1. Branchial and pulmonary apparatus seen from the dorsal aspect. *a*. First lobe of the tongue. *b*. Second lobe of the tongue. *c. c*. Divaricated sides of the pharyngeal aperture, which has been slit open. *d*. Pharyngeal valve. *e*. Laryngeal aperture. *f*. Laryngeal or thyroid cartilage. The figures 1, 2, 3, 4 & 5, indicate the interspaces between the six branchial arches on each side, which conduct the water to the branchial chamber. *k*. The membranous trachea or ductus pneumaticus: its communication with the right lung is shown.

2. The same parts, with the heart, seen from the ventral aspect. *a*. The auricle; the letter is placed on the left appendix. *b*. The ventricle, laid open to show the termination of the vena pulmonalis, in which a black bristle is placed; the wide orifice of the auricle, and the aortic opening through which a white bristle is passed. *c*. The *bulbus arteriosus*, laid open to show the longitudinal valvular processes in its interior. *d*. Pericardium. *e*. *Vena cava abdominalis*. *f*. *Vena pulmonalis*. *g*. Arterial trunk common to the systemic, branchial and pulmonary circulations. The figures 1, 2, 3, 4, 5 & 6, indicate the branchial arteries on each side, of which the 2nd and 3rd chiefly go to form the pulmonary artery, *l*. *m. m*. The two divisions of the pulmonary artery, for the two lungs. *n. n*. The two corresponding veins, which return the aërated blood to *f*.

Tab. XXVII.

Fig. 1. A scale of the *Lepidosiren annectens*, magnified eight diameters. *a*. The inserted margin; *b*. the thick cuticle reflected from the posterior margin.

2. Mouth of the *Lepidosiren annectens*, twice natural size. *a*. The intermaxillary teeth. *b*. The three projecting angular pro-

cesses of the *right* maxillary dental plate. *c*. The corresponding processes of the left mandibular dental plate. *e*. A bristle inserted into the *right* olfactory sac, which opens upon the upper lip. *e'*. The left olfactory sac laid open, exposing the double series of olfactory laminæ.

Figg. 3 & 4. Brain and organ of hearing of the *Lepidosiren*, twice natural size.

a. a. Cerebral hemispheres. *b*. Optic lobe. *c*. Medulla oblongata. *d*. Cerebellum and fourth ventricle. *e*. Pineal gland. *f*. Bilobed pituitary body, *forming the floor of* the third ventricle. *g*. Mammillary body. *h*. Olfactory nerves. *i*. Optic nerves. *k*. Cartilaginous wall of acoustic chamber or labyrinth. *l*. Sac and nerve of smaller otolithe. *m*. Sac and nerve of greater otolithe. *n*. Semicircular canals. *o*. Fifth pair of nerves. *p*. Eighth pair of nerves.

5. Brain of the *Menopoma*. (From Meyer, Analekten fur Vergleichende Anatomie, tab. vii. fig. 5.)

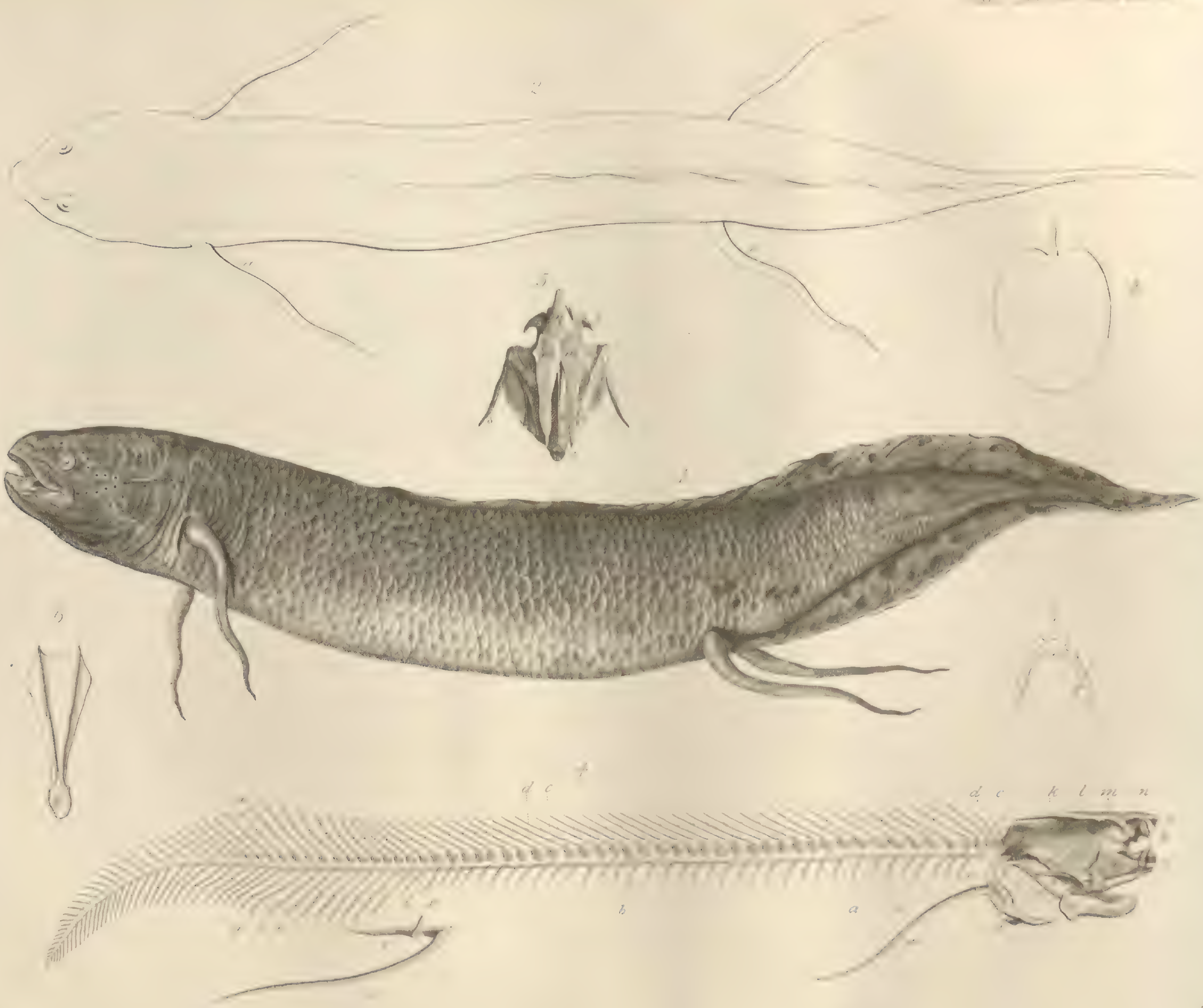
6. Brain of the *Menobranchus*. (Ibid. tab. vii. fig. 6.)

Both these figures are of the natural size.

The same letters indicate the same parts as in Figg. 3 & 4.

7. *a*. Œsophagus. *b*. Stomach. *c*. Intestine. *f*. Liver. *g*. Gall-bladder. *h. h*. Kidneys. *i. i*. Ureters; both are reflected downwards and outwards to show, *k*. Allantoid bladder. *l. l*. Ovaria. *m. m*. Oviducts. *n. n*. Anterior apertures of the same.

These parts are figured as seen from behind.



C O & H. Scharf del.

G. Jarman sc.

C. O. & H. Scharf del.

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C. O. & H. Scharf. del.

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1

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R. O. & H. Scharf del.

G. Jarman Sc.

R. O & H Scharf del.

G. Jarman Sc.

XXI. *Observations on the* Spongilla fluviatilis. *In a Letter to the Secretary.* *By* John Hogg, *Esq., M.A. F.R.S. L.S. & C.P.S.*

Read June 5th, 1838.

I HAVE taken the liberty of troubling you with some specimens of the River Sponge (*Spongilla fluviatilis*), for the purpose of calling the attention of the members of the Linnean Society to this curious substance, and more particularly to the seedlike bodies which are so abundantly contained in one of them.

This species of Sponge is synonymous with *Spongia fluviatilis*, Linn. and Pallas, *Spongilla friabilis* (De Lamarck), *Ephydatia fluviatilis* (Lamouroux), *Tupha fluviatilis* (Oken), and *Halichondria fluviatilis* (Fleming); and was taken by me last August from a rivulet at Norton in the county of Durham.

You will perhaps be surprised that I should even hint at, much less express any doubts respecting the animal nature of the Freshwater Sponge; for modern naturalists have long been almost unanimous in assigning to it a station in the class Zoophytes, and in which are likewise included the Marine Sponges. But I must mention that Dr. George Johnston, who is both an excellent zoologist and botanist, has decided upon restoring the Sponges to the place they formerly occupied in the vegetable kingdom; and I will merely refer you to his reasons for this decision in his "History of British Zoophytes," given in the first volume of the "Magazine of Zoology and Botany," at pages 229 and 230. Hence it appears that there still exists amongst authors some uncertainty concerning their true nature*. Now, my chief object in exhibiting these specimens of *Spongilla* is to endeavour to excite some naturalist to make attentive observations on this singular production,

* See likewise a paper "On the Situation and Rank of Sponges in the Scale of Nature," &c., by Mr. J. E. Gray, contained in the Zoological Journal, vol. i. p. 46.; and Mr. Bell's "Remarks on the Animal Nature of Sponges," at p. 202 of the same volume, published in 1824.

and principally by examining its manner of growth from its small seedlike body, and by comparing it with the similar origin and increase of certain Cryptogamic vegetables from their seeds or sporules ; and by contrasting it with the mode of formation of some of the lower animals from their minute eggs or ovules, some fact very probably may be elicited which is found to take place only in the one division of nature, and not in the other, and thereby enable him to determine with accuracy to which it ought really to be referred.

These seedlike bodies on being magnified so exactly resemble true seeds, that it is difficult to imagine that they can be the germs or ovules (*ovula*) of animals : in shape they are like small Pomegranates, or still more so, the seeds of the South American Quinoa (*Chenopodium Quinoa*). But they must be steeped a little while in water before they are placed under the microscope, in order to raise their tops or upper portions, which, resembling small dimples, by desiccation contract or become somewhat drawn in.

The seedlike bodies, sporidia, or sporules, if the *Spongilla* be a vegetable, or small ova, or ovules, if an animal, which are so numerous in the largest specimen I have the pleasure of presenting this evening, resemble a good deal those belonging to the Lake Sponge* (*Spongilla lacustris*), and which are figured in Esper's work on Plant-Animals—"Pflanzenthiere," vol. ii. *Spong.* tab. 23, A.

Linnæus in his "Flora Suecica," classed the Freshwater Sponges with the *Algæ*, and thus writes of the small bodies in the *Spongilla fluviatilis* : "Semina lentiformia, in omni hujus poro, autumno conspiciuntur." (Vide p. 440. edit. 2. 1755.).

Oken in his "Lehrbuch der Naturgeschichte," vol. iii. *Zool.* Abth. 1. Jena, 1815, under the description of this kind of *Spongilla*, which he names *Tupha*, observes, "This must be the habitation of the *Cristatella* :"—"Soll das Gehäus von *Cristatella* sein," p. 78. And again, at p. 54, in his account of the *Cristatellæ*, he further adds, "The Freshwater Sponge must be their chosen retreat or cells, which is extremely probable. The grains that are found so

* Professor H. F. Link in a very interesting memoir, wherein he says that the Sponges ought to be separated from the *Zoophytes* and restored to the *Algæ*, has well described the seedlike bodies or sporidia of the *Spongilla lacustris*. I was unfortunately not aware of its existence till long after my letter was written. Vide "Annales des Sciences Naturelles, Seconde Série, tom. ii. *Botanique*." Paris, 1834, p. 328.

frequent in such Sponge must be their eggs."—" Der Schwamm des süssen wassers soll eine absonderung ihrer köhren oder zellen sein, ist sehr wahrscheinlich. Die körner, welche man so häufig in solchen schwämmen findet, sollen die eier sein."

Lamouroux, at page 3 of his "Hist. des Polyp. Corall. Flex." 1816, says, "Linné . . . . . . dit qu'en automne on voit des semences dans l'Eponge fluviatile. Kalm semble avoir copié le naturaliste Suédois. Ces auteurs prenaient pour des fructifications, des Cristatelles desséchées, ou des grains opaques d'une substance encore inconnue, dont les Eponges d'eau douce se trouvent quelquefois entièrement remplies."

Also, De Lamarck inquires, "Les petits grains observés dans les Spongilles seraient-ils des gemmes propres à produire les Cristatelles, comme l'observation de Lichtenstein* semble l'indiquer?" (p. 99. tom. ii. of "Hist. Nat. des Anim. sans Vert.," edit. 1816.)

Hence, from these last three passages, we find that Lamouroux held these seedlike grains not to pertain to the *Spongilla*, but that they were dried or withered *Cristatellæ*, or else certain opake grains belonging to some unknown substance: and MM. Oken and De Lamarck inclined to consider them as the eggs or reproductive germs or gemmules of the *Cristatella vagans* (De Lamarck). This small polypary in its different stages, and several of its polypes, are well represented in Rœsel's "Insecten," vol. iii. tab. 91. p. 559.

Now I cannot for a moment suppose that these seedlike bodies are the germs or ovules of the *Cristatellæ*, partly for this reason; because I have not yet succeeded in discovering any of those minute Zoophytes in the same rivulet which the *Spongilla* inhabits; and as I have found the same bodies to be abundant in different specimens of the *Spongilla fluviatilis*, not only in the summer and autumn, but also in the spring: it is extremely remarkable, and indeed most improbable, that I should not have been able to notice the *Cristatellæ* in different stages of their development in that water, if these bodies were in reality their ovules or germs; whilst, on the contrary, I have con-

* There is an article by H. Lichtenstein on Sponges (*Suesvampene*) in "Skrivter af Naturhistorie," 4 Bind, 1 Hefte, Kiobenhavn, 1797, where he, at page 115 and the following page, speaks of the river Sponge (*Flod-suesvamp*): but, being written in Danish, I have not been able to read it, though I presume the author is the same Lichtenstein mentioned by De Lamarck.

stantly seen specimens of this *Spongilla* of various sizes and gradations, and to all appearance as if they had originated or been produced from these singular seedlike bodies. Moreover, last March, having procured some of these fresh bodies, I placed them in a glass vessel, nearly filled with spring water, and changed the water every day; six of them soon affixed themselves to the bottom of the glass*, and in about three weeks every one of them was covered with a whitish and wooll-like substance, which I took for the rudiments or commencement of the Sponge†. After that time I was obliged to leave home, and consequently to give up all further investigations upon that interesting subject.

I ought also to inform you, that I find from experiment these seedlike bodies, when dried and long kept out of water, exhibit no such appearances, and seem, when replaced in water, as if they had lost all their vitality and power of reproduction; neither have I perceived that they possess, even in a fresh state, any cilia nor any locomotive property‡ whatever, wherein they essentially differ from the similar germs, or ovules, or sporules, of certain species of the Sea Sponges, as described by Dr. Grant§.

Pallas in a note to his description of *Spongia fluviatilis* (p. 385. "Elenchus

* This glass vessel, with these same specimens, was exhibited to the Society on December 18th, 1838. Upon examining the small white patches with a lens, they were found to be the true rudiments of the *Spongilla*, having the cells or pores very distinct, and formed by the little anastomosing fibres or spicula.

† A short time after this letter was read, my attention was called by my friend Professor Bell, to Mr. Gray's paper (with which I was previously unacquainted) in the Zool. Journ. vol. i., where at p. 50 I noticed that he mentions squeezing the granules from some specimens of freshwater Sponge, and adds, "There were a few partly decayed leaves at the bottom of the basin, on which the green granules fell. Being called away, I left them there for a day or two, when on my next examination I found they had formed a more velvety mass, through which visible fibres were shooting, which gradually enlarged, thus growing entirely after the manner of vegetables." This is a pleasing confirmation of my own experiment.

‡ Nor has M. Dutrochet noticed the power of locomotion in the similar bodies which belong to the *Spongilla lacustris*. His remark is as follows: "Enfin M. Grant a fait cette observation neuve et curieuse que les corps oviformes, ou les œufs de l'Éponge, lorsqu'ils sont détachés et devenus libres, sont animés de mouvemens spontanés comme des animaux. Je n'ai point fait cette observation sur les corps oviformes de la Spongille, que je regarde comme des sortes de tubercules." Vide Annales des Sci. Nat. tom. xv. p. 217.

§ Vide p. 382. vol. xiii. of the Edinburgh Philosophical Journal for 1825; p. 154 of the Edinb. New Phil. Journ. for 1826; and p. 129 of the same Journal for 1827.

Zooph.") thus mentions what he considered remarkable specimens: "Spongia vulgaris fluviatilis in aquis stagnantibus sæpè crassis crustis fundum obducit. Talis crustæ fragmenta parvulis *Phryganearum* larvis, membranaceis tubulis in spongiosa substantia nidulantibus scatentis monstravisse mihi olim summum apud Gœttingenses Botanicum celeberr. Büttnerum memini; nec similes unquam invenire ipse potui." So one of my specimens will show how this Sponge is seen occasionally to fix itself and to spread upon the tube or case of a Caddis or Cadeworm, as related in the passage just cited. Another specimen here presented is interesting from its parasitical mode of growth, because it has invested a moss (*Hypnum riparium*, Linn.) in a very beautiful manner. In short, I may safely infer, from the many different substances to which I have noticed the *Spongilla fluviatilis* attached, and from the many curious places wherein I have observed its seedlike bodies growing, that wherever one of these bodies can obtain a lodgement for itself, there it increases and flourishes*, and consequently, that these bodies are in fact the true sporules† or ovules of the River Sponge, be it a vegetable or an animal production.

Lastly, I beg to submit to your notice three specimens of the small freshwater Polypary, named *Plumatella repens* by De Lamarck, which I discovered, for the first time I believe in England, in the month of August last among some patches of the *Spongilla* from the same rivulet.

* Two or three of these seedlike bodies having lodged in the mouths or openings of two fluviatile shells that form part of the case of the caddis or larva *Phryganeæ*, now exhibited, clearly prove this: they also show how the sponge begins to be developed.

† Having yesterday received the new number (for July 1838) of the "Annales des Sciences Naturelles," seconde série, tom. x. *Zoologie*, I have just perused the "Observations sur les Eponges et en particulier sur la Spongille ou Eponge d'eau douce, par M. F. Dujardin." At page 9, this author, who is convinced of the animality of Sponges, states, "Dans ces diverses parcelles vivantes, on voit des granules colorés en vert au printemps, grises ou jaunâtres à l'arrière-saison, et que je ne puis regarder comme des organes importans, ou comme des ovules de l'Eponge." But the experiments mentioned in the preceding notes at page 366, will entirely refute the opinion of M. Dujardin, and prove without a doubt that these are in reality the reproductive bodies of the *Spongilla*. On the other hand, M. Dutrochet, in his very able "Observations sur la Spongille rameuse (*Spongilla ramosa*, Lam., *Ephydatia lacustris*, Lamour.," *Spongia lacustris*, Linn.), and in which he advocates the vegetability of that species of Sponge, adds concerning its seed-like bodies, "Ces corps sont donc des espèces de tubercules, ce sont des réservoirs de matière nutritive pour servir au développement du végetal, et à sa reproduction au printemps." See Annales des Sciences Naturelles, tom. xv. p. 212, 1828.—J. H., December 19, 1838.

XXII. *Further Observations on the* Spongilla fluviatilis; *with some Remarks on the Nature of the* Spongiæ Marinæ. *In a Letter to the Secretary. By* John Hogg, *Esq., M.A. F.R.S. L.S. & C.P.S.*

Read December 18th, 1838; and June 4th, 1839.

As I had an opportunity during this last summer of making additional researches on the River Sponge, I think it necessary to lay before the Linnean Society some further observations relating to that substance, in order to correct, to elucidate, and to confirm several passages in my former letter, and likewise to add a few remarks upon the nature of the Sea Sponges.

In the first place, I ought to mention to you that I was not aware, until some time after my last communication had been submitted to the Society, that there are other eminent naturalists, besides Dr. George Johnston, who at this day advocate the vegetable nature of all Sponges; and these I understand are, Dr. H. F. Link, Professor of Botany at Berlin; Dr. J. Müller, Professor of Anatomy at Berlin; and Mr. J. E. Gray, of the British Museum. Of whom the several opinions may be examined in the following works: Transactions of the Royal Academy of Sciences at Berlin for the year 1830, Berlin, 1832, p. 109. "Uber die Pflanzenthiere überhaupt und die dazu gerechneten Gewãschse besonders," von Hrn Link. "Annales des Sciences Naturelles, Seconde Série, tom. ii. *Botanique*," Paris, 1834, p. 328. "Sur les Zoophytes en général et en particulier sur certaines Plantes qu'on a confondues avec eux," par H. F. Link; being a translation of part of the former memoir. Müller's "Elements of Physiology," translated by Dr. Baly, Lond. 1838, vol. i. p. 42. And the "Zoological Journal," Lond. 1824, vol. i. p. 46, 'On the situation and rank of Sponges in the scale of Nature,' &c., by Mr. J. E. Gray.

Also, MM. Dutrochet and Gervais consider that the Freshwater Sponge belongs to the vegetable kingdom; in proof of which, the facts and arguments

as brought forward by the first author may be learnt in perusing the 'Observations sur la *Spongille rameuse* (*Spongilla ramosa*, Lamarck; *Ephydatia lacustris*, Lamouroux), par M. Dutrochet,' "Annales des Sciences Naturelles," p. 205. tom. xv., 1828. But the only notice I can find of M. Gervais's opinion is contained in a very late paper by M. Dujardin, published in the second series of the same Annales, tom. x. *Zool.* p. 11. And I should moreover remark, that Baron Cuvier, in both editions of his "Règne Animal," has made no mention of the *Spongillæ*, or Freshwater Sponges, and has expressly described "les Eponges" as being "corps marins*." We must then conclude that he had entirely overlooked them; or, what is more probable, that he had considered that they are *plants*, and therefore were not the subjects of his work.

Dr. Johnston, as will be seen from his beautiful book entitled "A History of the British Zoophytes," which has only just been given to the world, at p. 28, still retains the same views on this subject as he did in the work to which I have before referred.

Next, it becomes me (however unwilling I may originally have been to entertain such an opinion†) to state, that I now feel satisfied this species of Freshwater Sponge is truly a plant, and not either a simple individual animal, or a group of aggregated animals, or the structure or production of any animal whatsoever. Many careful and repeated experiments upon different specimens of the *Spongilla fluviatilis* have at length convinced me that such is the real nature of it; and the results of those experiments I will here, as briefly and clearly as I am able, detail to you.

About seventeen months ago, I observed that the green colouring matter in the River Sponge was occasioned by the action of light, because sand-coloured or pale brown specimens gradually became green by being subjected to the daylight, and more especially so when exposed to the full rays of the sun: whilst, on the contrary, pale specimens, when confined in a dark place, or

* Voyez Règne Anim. tom. iv. p. 88, edit. 1817; et tom. iii. p. 321, edit. 1830.

† It is almost unimportant to remark that in my short catalogue of *Polyparia*, published in my "Sketch of the Natural History of the Vicinity of Stockton-on-Tees," Stockton, 1827, it will be noticed that I arranged the genera *Spongia* and *Spongilla* in my last order, *Gelatinifera*, of family 3. *Creatoidea*, section ii. *Composita*. Since Dr. Johnston has given the synonyms and references to that catalogue in his "British Zoophytes," I may perhaps be excused for adding this note.

being deprived of light, after many days received no green tint, but continued of a light buff or a yellowish white colour. Thus, then, by the exactly similar influence of light upon the chromule*, or colouring matter in plants, and likewise by the etiolation, or blanching of vegetables by the absence of light, so well known to every one, very favourable proofs may, from these analogous phenomena, be most reasonably adduced with regard to the vegetable nature of the *Spongilla fluviatilis.*

The circumstances that led me to the investigation of those appearances are described in a paper†, which at the date of my former letter to you had not been read before the Royal Society, to whom I was induced to communicate it. I therefore did not consider myself then at liberty to make any mention of them to you; although they, together with some observations on the seedlike bodies of the *Spongilla*, already described in that letter, created in my mind considerable doubts as to the animality of that substance. Renewed and similar observations upon several fresh and living masses of the River Sponge, during the summer which has just passed, have now confirmed me in the correctness of those doubts, and in the certainty of those facts which afford the stronger proofs of the real vegetability of that Sponge. Of such proofs, indeed, which I was then about to pronounce as quite conclusive on that point, are the effects that I had noticed, caused by the presence and absence of light, upon the colours of that substance, the germination of its seedlike bodies, sporidia, or sporules, and their subsequent plantlike mode of growth and of increase; and whilst engaged in these researches, I was greatly surprised in discovering (on the 12th of August, 1838,) the only traces that could with any degree of probability be advanced in favour of the supposed animality of the *Spongilla*, namely, certain remarkable germlike bodies swimming about in the basin of water, wherein a beautiful mass of that Sponge, growing with great vigour and attached to a stone, was contained. At first I was disposed to think that they

* Prof. DeCandolle uses this term to signify that matter which produces the colours in flowers, the green in leaves and other parts of plants, and is contained in their cells in the shape of globules.—See Organographie Végétale, tom. i. p. 19. Paris, 1827.

† See a short notice of this paper in the Philosophical Magazine, vol. xiii. p. 457, for December 1838; and another entitled, "De l'Action de la Lumière sur la Couleur de l'Éponge de Rivière," in the *Bibliothèque Universelle de Genève*, tom. xix. p. 207. (Janvier, 1839).

were extraneous and parasitical bodies, entirely independent and unconnected with the material of the Sponge itself, because they did so extremely resemble some of the Infusorian Animalcules.

These bodies are very minute, though some are less than others, and are plainly visible to the naked eye; they are white, of a somewhat globular, or rather, more oval shape, the lower or smaller portion being opake, and the upper transparent and membranous. Their movements in swimming were no less astonishing than elegant; ascending from the Sponge at the bottom of the water to the surface; floating gently on the surface; or traversing the middle of the fluid, like a balloon in the air; or suspending themselves nearly in one spot; or whirling round and round, describing larger or smaller circles in the water; approaching or avoiding each other; but, when performing their quicker progressions, they move along on their sides with their rounder ends precedent. Indeed Baker's account of the motions of the *Volvox globator* *, which he calls the Globe animal, is so strikingly descriptive of the movements of these germlike bodies, and so similar, that I trust you will pardon me with quoting it here: "It moves in all directions, forwards or backwards, up or down, either rolling over and over like a bowl, spinning horizontally like a top, or gliding along smoothly without turning itself at all. Sometimes its motions are slow, at other times very swift; and when it pleases, it can turn round (as it were upon an axis) very nimbly without removing out of its place†." Rœsel has depicted that minute Infusorian in his work on 'Insecten,' vol. iii. plate 101, at figures 1 to 3 inclusive. Yet the germlike bodies more nearly in form resemble the description of *Volvox globulus*‡; so much so, that

* But the spontaneous movements of the *Volvox globator* are performed by the agency of *cilia*: for, according to Dr. Ehrenberg, its body is furnished with those minute organs. So indeed Baker suspected; and he thought that it appeared as if it were set round with short moveable hairs.

† See "Employment for the Microscope," by H. Baker, 2nd edit., Lond. 1764, p. 323.

‡ This species I have never met with. But I have just seen many living specimens of *V. globator* under the microscope. I could easily perceive some differences between them and the locomotive germlike bodies of the River Sponge, as well with respect to their colour and structure as their motions. These *Infusoria* are yellower, much more transparent, and more completely globose; within many of the larger are distinctly seen several young or round transparent balls, which altogether resemble their gravid parents; they swam and moved about with greater power and vigour; and their more active and busy movements struck me as if they were under a more decidedly spontaneous control or influence. Rœsel's figures above referred to are accurate.—J. H., May 16, 1839.

I felt assured of the extreme likelihood, nay, almost certainty, of their being identical. And with the view of ascertaining whether they were or not such animalcula, I put several of the germlike bodies into a wine-glass full of spring-water, adding fresh daily to them; after a day or two their gyratory motions became weaker and slower, and at length they entirely ceased: then the bodies attaching themselves to the bottom and sides of the glass, and losing their original shape, became flatter; the transparent membranes of their upper portion disappearing, the white opake portions alone were left, which, resembling minute specks, at the expiration of a few more days increased to such a sufficient size as to show, with the aid of a magnifier, that they are undoubtedly the rudiments of the *Spongilla* itself, and thus proving that they are its reproductive bodies or sporules, and not merely, as I had conjectured, parasitical *Infusoria**. I have taken the liberty of bringing for exhibition this evening that same wine-glass, wherein the small specks are distinctly seen, and which, when submitted to inspection under a microscope, will be found to be the commencements of the Sponge, in which the young fibres or spicula are already visible.

One of these bodies I likewise put by itself in a watch-glass containing a little water, which I placed on the stage of the microscope for the purpose of continuing to witness with that instrument more minutely its process of development; the water being changed two or three times a day, the germlike body at first moved a good deal about the glass; it then began to keep nearly in the same place, only turning gently round as if on its axis; becoming afterwards stationary, it fixed itself to the glass, and changed into a small spot of a white opake substance; which, while growing in the water, appeared under the microscope to be solely gelatinous, but when it had been dried for a day or two, minute cells and fibres or spicula were manifest.

At this time I was repeating the experiment of growing the *Spongilla* from its seedlike sporidia or sporules, as I had only imperfectly done so in the preceding March. Having taken many of these fresh seedlike bodies from

* I must say, that it is probable that some of those bodies which are now referred to the *Infusoria* will hereafter turn out to be only the sporules of certain fluviatile and marine plants.

their fixed* localities in the cells or pores of the Sponge, I deposited them in a china dish nearly filled with water, which I renewed twice a day. I was most attentive in examining not only with my naked eye, but also with a powerful lens, whether these bodies possessed any spontaneous motions, but could not discover the least appearance of any; on the contrary, the instant they were put into the water they sunk to the bottom of the dish; there remaining motionless, most of them commenced to germinate, and became permanently fixed. Several of these seedlike bodies being of different sizes, I found that some began to grow sooner than others, probably by reason of their being in a more mature state. The manner of germination, according to my observation, is this: when the seedlike body has lain a sufficient time in the water, a very small quantity of a soft opake substance appears spontaneously protruding from its apex or orifice at its top; it is of a pure white colour, and soon glues the seedlike body to the dish; this substance gradually increases, and sometimes entirely enveloping the parent body, continues spreading over whatever object it has attached itself to. At first there are no distinct traces of the Sponge itself, but only a white thick gelatinous matter, like a piece of wet cotton-wool, is all that is to be seen: this, however, when allowed to dry, will exhibit the thin membrane of the Sponge, and the oscules and cells or pores formed by the interlacing and crossing of the young fibres with the sharp and prominent spicula. As a few of these bodies, after several days, did not germinate, I squeezed them sufficiently hard so as to break their envelopes or shells, and pressed out a little of the inner opake substance, which then very readily grew and enlarged.

Having thus clearly proved that this *Spongilla* is capable of being reproduced or grown both from its fixed seedlike, and from its locomotive germlike, bodies†, it therefore is to be further inquired concerning the real nature of them.

* M. De Lamarck is wrong where he has defined these bodies as "granula plurima gelatinosa non affixa in cellulis." (An. sans Vert. tom. ii. p. 98. edit. 1816.) But M. Dutrochet thus correctly describes the like bodies in the *Spongilla lacustris*: "corps oviformes de couleur jaune, et qui adhéraient au tissu fibreux." (p. 206.) Again, at p. 211, he says, "les fibres les plus grosses auxquelles étaient fixés d'innombrables corps oviformes." See Annal. des Sci. Nat. tom. xv.

† It perhaps seems inconsistent to say that the Sponge may be reproduced from both these bodies. But I will thus explain it: the fixed seedlike body contains within it a somewhat transparent jelly

Now the opinion which first struck me was the actual identity of these two bodies; that is to say, that the latter are only a younger and less mature condition of the former bodies; and this indeed appeared to me not improbable, considering that (although the same mass of Sponge possesses at the same period both sorts) they both in certain of their stages mutually approach very near in appearance and size to each other; for I have noticed in the same fresh specimen the least seedlike bodies to be of a white colour with their envelopes soft and destitute of any apparent orifice at their tops.

Again, the largest germlike bodies which I have seen were more globular in their shape, without any terminal orifice, having the enveloping membranes, except a very small portion at their upper extremities, no longer transparent, by reason of the quantity of the opake matter having so much increased within them: the colour also of some that I preserved in spirits had lost its original whiteness, and changed to a yellowish brown or buff, the most usual colour of the full-grown seedlike bodies. Hence my grounds for supposing that the germlike bodies are only early forms of the seedlike bodies, which they would ultimately become when either sufficiently matured or at their proper season of the year*.

To this, however, there is one objection, namely, the absence of all papillæ in the one, and the presence of them in the other: yet I think it not unlikely that the seedlike bodies once possessed those organs; for on being highly magnified, their outer shells appear indented with small dots, which make me rather imagine that they are the spots where the papillæ may have originally been attached, but which, on the maturity of those bodies, either all or part decayed or enlarged into fibres, whereby they are fastened† within

intermixed with very small granules (most probably the young locomotive germlike bodies), which also seem to contain a particle of the same jelly, that will increase with the growth of the granules, after they may have escaped from the former body. Now I think, from my own observations, it is clear that this jelly is alone the reproductive or vital portion from which the substance of the sponge itself originates.

* Of course many of these would never ripen into seedlike bodies; viz. those which have emerged from the pores and canals of the parent structure, and having swum to a convenient spot, there begin to grow. These form an exception to the above supposition, which can only apply to such numerous germlike bodies as cannot escape from the fibrous network of the Sponge.

† Some of the fixed seedlike bodies frequently become detached by the decay of their connecting fibres or tubules; by the burrowing and tearing of insects, and other parasitical animals; or by the

the cells or pores of the Sponge. This opinion is, I think, worthy of additional investigation, because to the exterior of the shells of the seedlike bodies certain fibres or tubules are often appended.

In pursuing the same inquiry, the following is another supposition which has occurred to me; that the seedlike bodies are the sporidia, and the germlike bodies the sporules of the River Sponge, because I found that on opening the seedlike bodies the soft white opake substance with which they are filled, when spread out and submitted to a great power of the microscope, consists of numerous granules interspersed among a somewhat transparent jelly*. These granules are round or egg-shaped, exceedingly minute, and quite diaphanous, except as to a spot, which is evidently a particle of the same jelly. And as the seedlike bodies themselves are fixed within the cells of the Sponge, they ought strictly to be considered as the seed-vessels or sporidia, and the granules contained within them as the seeds or sporules. Also, since the sporidia when apparently full grown have an orifice at their upper extremity whereby the gelatinous substance and granules escape, the latter, if identical with the germlike bodies, pursuing their way through the water that fills the passages or canals formed by the fibrous network of the Sponge, emerge and swim or glide about by means of their locomotive power, until they have attained sufficient maturity, and have procured for themselves a safe lodgement; they then begin to germinate and vegetate by degrees. However, I need scarcely observe to you, that further experiments are necessary to determine which of these two suppositions is the true one, that is to say, whether the locomotive germlike bodies ultimately become identical with the fixed seedlike bodies, or whether the former are the real sporules, and the latter the sporidia; yet I may add, that I am most strongly inclined to the latter.

Again, having before remarked that the only traces from whence I could at all infer the animal nature of the River Sponge were its locomotive spo-

decaying or breaking of parts of the Sponge itself; or by many other causes. They then, attaching themselves to whatever suitable substance they may happen to fall upon, quickly germinate.

* Professor Link has observed the same sort of substance and granules (séminules) in the similar seedlike bodies (sporanges) of the *Spongilla lacustris*. He has described them thus: "Lorsqu'on écrase ces conceptacles de graines et qu'on les regarde avec un grossissement très fort, on voit les séminules plongées dans une masse qui est molle tant qu'elle est fraiche." (Annales des Sciences Naturelles, Seconde Série, tom. ii. p. 328.)

rules, and as they are so extremely similar to those of certain species of the Marine Sponge, which were discovered in 1825 by Dr. Grant, I could not help thinking that in spite of the strong evidences which I had indisputably obtained in favour of its vegetable nature, I had also discovered one, which would perhaps go far in proof of its animality, and thus compel me to become somewhat of an unwilling believer in the monstrous theory which has of late years been revived amongst some foreign naturalists*, that certain bodies belonging to several Cryptogamous plants are at first animals, and that after a time they change into true vegetables†. Notwithstanding the power of locomotion has generally been accounted as one of the strongest tests of animal life, and that which constitutes the most obvious difference between an animal and a plant, still this power is not alone confined to the beings included in the first great division of nature; for many observers have witnessed it in subjects which pertain to, and really are members of the second division, or the vegetable kingdom. I here allude to the extraordinary phenomena, which have been noticed by some distinguished botanists on the Continent, as to the locomotive powers of the seeds or sporules of certain *Confervæ*, as well as of other plants belonging to the *Algæ*; and more especially to the singular discoveries of Dr. Unger in 1826, which relate to the spontaneous movements of the seeds of the *Ectosperma clavata* of Vaucher‡. The original memoir descriptive of these appearances is contained in the Act. Acad. Nat. Curios. vol. xiii. p. 791. Bonn, 1826, with an accompanying plate.

* As far as I can find, Münchausen was the first author of this theory nearly half a century ago, but he seems to have obtained few followers until very recently. For further opinions on this theory refer to *Nématophytes*, p. 524, vol. lx. of the *Dictionnaire des Sciences Naturelles*, edit. 1830: likewise the articles *Némazoaires* and *Némazoones*, at p. 365, vol. xxxiv. of the same *Dictionnaire*; and the article *Psychodiaires*, p. 516 of vol. xliii. of the same work.

† This theory may be termed the Zoocarpical, or that relating to imaginary animal-seeds. Dr. Roget writes, "The tribe of *Zoocarpia*" (certain of the *Cryptogamia* I suppose) "produce a kind of fruit (seed), which when detached from the parent, appears to possess powers of spontaneous motion until the period of its taking root, and growing like a vegetable structure." Note, p. 156. vol. i. Roget's Bridgewater Treatise. But according to M. Bory de Saint-Vincent, with whom the name originated, "'les *Zoocarpes*' sont les séminules animés, des véritables végétaux;" *i.e.* the live or animate seeds of certain true plants.

‡ This plant is synonymous with the *Vaucheria clavata* of DeCandolle; and the *Conferva dilatata* β. *clavata* of Roth, and γ. *bursata* are only different states of the same.

And a portion of it is translated in an article "On the Metamorphoses of the Reproductive Bodies of some *Algæ*, said to possess successively an animal and a vegetable Existence," in the Mag. of Nat. Hist. vol. i. no. 4. for November 1828, p. 307, and is illustrated by a wood-cut. Here the locomotive globules, or more correctly the sporules or germs of the *Ectosperma clavata*, are described as being "oval, dark at one extremity, and almost transparent at the other;" which characters exactly resemble those of the sporules of the *Spongilla*. Also the account of their movements and mode of swimming is very nearly the same, and is thus translated in p. 307: "The minute globules (were) unequal both in colour and size. Many of them swam freely here and there, moving at their option, in one way or another, retiring and approaching one another, gliding round globules that were motionless, stopping, and again setting themselves in motion exactly like animated beings." I have therefore no hesitation in asserting that the movements of both are in all probability effected by the same means.

But it unfortunately does not appear from Unger's figures in tab. 40, that any powerful microscope had been used to magnify the locomotive sporules in question, in order to prove whether or not they possessed cilia, or any other like organs, by which their motions might be partly or altogether performed. Nevertheless I have taken much trouble in endeavouring to ascertain by what means the sporules of the River Sponge swim and move about.

Under the highest power of Jones's improved compound microscope, with which my observations on these sporules, whilst in their fresh and locomotive state, were made, I could only perceive certain rapid streams or currents taking place on their sides, which induced me to think they were currents or vibrations in the water caused by little tufts of cilia, with which the membranous coverings of the sporules seemed to be furnished, and by which their movements, as I fancied, were effected. But having selected many of these sporules when in full possession, and at the time they were actually making use, of their moving power, I preserved them in a phial of spirits*: some of these I have lately (November 26th) re-examined under a more modern and perfect instrument, one of Powell's compound microscopes, and belonging to

* This phial, containing many of these locomotive sporules immersed in spirits, I beg to present to the Society.

Professor Don, by whose kind assistance I was enabled to see these bodies magnified 400 times: even at such a high power we both were unable to discern the presence of any cilia, but most distinctly observed the entire covering or membrane of the sporules to be studded all over with short papillæ. Now it is very probable that the currents in the water, which I supposed to have been caused by the rapid vibrations of tufts of cilia, were currents produced by a reciprocal action, or, to use the terms of M. Dutrochet, by an endosmosis and exosmosis, *i. e.* by an inward and an outward impulsion of fluids, not only through the membranes of these sporules, but also through these membranaceous papillæ, in accordance with the discoveries of that distinguished physiologist. Wherefore, the currents so produced would I conceive be a satisfactory mode of accounting for the singular and beautiful phenomenon of locomotion as exhibited in these sporules; and it is in pursuance of the philosophical views of Mr. Berkeley, F.L.S., as briefly mentioned by him in a paper "On the supposed Animal Nature of the Seeds of certain *Algæ*," published at p. 233 of Hooker's Journal of Botany, part 3, for July 1834*; although, if this hypothesis should ultimately not prove the correct one, we must endeavour at another opportunity to investigate the causes of that interesting phenomenon by a more minute and complete examination of the papillæ with which those sporules are so abundantly furnished, and whilst they are in a fresh state; for indeed I cannot but imagine that the function of locomotion must be in part carried on by means of the currents which I noticed in the water, proceeding from the sporules, and very possibly effected in some degree by a peculiar, but as yet unknown, faculty of the papillæ themselves.

Hence, from what has been said, it will be evident that locomotion being common both to some bodies pertaining to plants, and also to animals, the

* I think it better to insert here from that work Mr. Berkeley's own explanation of what he thinks the real case to be: "When the seed separates from the matrix, it passes into the water in which the plant is immersed. Now if the contents of the seed, which are semifluid, are of a different specific gravity from that of water, a mutual action of exosmose and endosmose will immediately take place through the epidermis of the seed: the water will pass into the seed, and part of the fluid matter of the seed will pass out into the water; and in consequence of this action, the current produced will cause the seed to move about, until an equilibrium take place, when the seeds will settle at the bottom and begin to vegetate." See, for additional remarks on the same subject, p. 28 of Berkeley's "Gleanings of British Algæ," Lond. 1833, where in plate x. the *Ectosperma clavata* is well represented.

moving sporules of the River Sponge cannot be considered as affording any test decisive of their animal nature; but, on the contrary, from the manner in which they began to vegetate, I am most fully authorized in holding them to possess far greater affinity with certain seeds, which are well known to belong to several *Algæ* or Cryptogamous plants.

I will now offer to you a few remarks on the locomotive germlike bodies of the Sea Sponges, as observed by Dr. Grant, because they bear so considerable an analogy with those similar bodies, of which I have before given a separate detail.

That acute naturalist has called them the ova of the Sponges, and has described them* as being quite visible to the naked eye, of a yellow or amber colour, somewhat translucent, egg-shaped, and tapering more or less at their narrow end. Their whole outer surface is covered with delicate projecting cilia, except their smaller extremity or base, which is supposed to be entirely destitute of them†. When viewed through a microscope, it is seen that the rapid vibration of the cilia produces a distinct current in the water, which always flows from their rounded towards their tapering end. They swim about by means of these cilia, always carrying their broadest extremity‡ or top forwards: they glide along with a regular and smooth motion; sometimes they come to the surface, and sometimes revolve round their axis. At length they fix themselves to a favourable spot, and, losing entirely their original form, become a flat transparent film§, through which the fibres shoot.

* The above description is abstracted from Dr. Grant's accounts published in vol. xiii. p. 382 of the Edinb. Phil. Journ. for 1825; p. 154 of the Edinb. New Phil. Journ. for 1826; and p. 129 of the same Journal for 1827.

† See figs. 26—29 of plate 2. in the Edinb. New Phil. Journ. for 1827.

‡ All the germlike bodies of the Sponges and the gemmules of the Zoophytes swim with their rounder ends or tops precedent. The reason of this I believe is, that those ends are the lightest; and their lower or tapering extremities, being filled with the opake and vital substance, are consequently the heaviest.

§ This mode of growth and development very greatly resembles that which takes place with the seeds or sporules of the *Fuci*. Stackhouse in his *Nereis Britannica* (fasciculus ii.) relates a curious experiment on the germination of the sporules of some species of *Fucus*, and adds, "In less than a week a thin membrane was discoverable on the surface of the pebble, where the seeds had lodged, with the naked eye; this gradually extended itself, and turned to a darkish olive colour. It continued increasing in size, till at last there appeared mucous papillæ or buds coming up from the mem-

Here, then, it will be apparent to every one how completely analogous the locomotive germlike bodies of certain kinds of Sea Sponge are to those of the River Sponge, and to the moving sporules of the club-shaped *Ectosperma*, but with this exception, viz. that the first bodies are said to be endowed with vibratory cilia. Nevertheless, I much desire that these bodies of the different Marine Sponges, of which only a few species have been described by Professor Grant, were again subjected to a more thorough and careful investigation, in order to establish with greater certainty the presence and nature of their supposed cilia or cilialike appendages. Because, until a more intense power of the microscope be brought to the examination of these bodies than I can learn from the papers already referred to in the Edinburgh Philosophical Journal*, to have been at that time used, I cannot hold it to be by any means decided whether those currents there detailed be caused by real cilia or not. And I am bound to state this as my opinion, yet with all due respect and deference to the able observations of Professor Grant, inasmuch as I have myself been nearly misled in regarding the currents issuing from the sides of the locomotive sporules of the River Sponge, as being the vibrations of tufts of cilia, as I have before mentioned, in consequence of using a microscope made about thirty years ago, and one of an inferior power; and had I not been so fortunate as to have just had the opportunity of resubmitting some of those same bodies to a more modern instrument of a considerably higher power, I should unquestionably have declared that those sporules were furnished with true cilia, and that the currents noticed by me were produced by the vibratory motions of such cilia: whereas, in fact, their supposed cilia have at length turned out to be merely papillæ.

Wherefore, having thus escaped from an unavoidable error, I feel the necessity of urging the re-examination of the locomotive germlike bodies of the Sea

brane: these buds, when viewed in the microscope, were rather hollow in the centre, from whence a shoot pushed forth." The germination also of the sporules of the River Sponge as observed by me, and described in a preceding page, is remarkably similar.

* Dr. Grant appears to have used a magnifying power of less than even 100 times in those researches; for he there writes, "I have used every effort in vain to detect them (polypi in the Sponge) with a microscope magnifying nearly a hundred times." Vide Edinb. New Phil. Journ. for 1827, p. 126. It is superfluous to comment on the great improvements that have been made in microscopes within the last twelve years.

Sponges. And I much suspect, that were these bodies belonging to several more kinds of *Spongia* magnified 400 or 500 times, what have hitherto been taken for cilia* will prove to be either papillæ similar to those in the sporules of the *Spongilla fluviatilis*, and that the supposed vibrations in the water are in reality only endosmose and exosmose currents through the membranes of these bodies and their papillæ; or else, if when slightly magnified they appear like the true cilia of animals, they will under a higher power of the microscope be ascertained to be small tubules, as well through which, as through the membranes of these germlike bodies, the same reciprocal action of fluids takes place, and thereby most probably effects their remarkably similar movements.

Moreover, since I have already attempted to describe the locomotive germlike bodies of the River Sponge, and have alluded to those of the Sea Sponge, the sporules of the club-shaped *Ectosperma* amongst plants, and the spontaneous movements of the Globe Volvox among the Infusorians, it only remains to consider, for the sake of comparison, the moving germs or gemmules of some animal which strictly belongs to the Zoophytes. For this object, I will select the locomotive gemmules of the *Alcyonium gelatinosum* (Linn.)†, as they have been so recently discovered by Dr. A. Farre, and by whose kind-

* Since Dr. Grant is evidently in error as to the tentacula of the *Sertulariæ* being ciliated, (see Edinb. Phil. Journ. vol. xiii. p. 101,) I cannot but think that he is under the like mistake respecting *cilia* being also present upon the locomotive sporules of the Sea Sponges. Both Dr. Johnston in his Brit. Zooph., p. 43, and Mr. Lister in his memoir in the Phil. Trans. for 1834, p. 377, have subsequently ascertained that the *Sertulariæ* have no cilia. The family *Sertulariadæ* belonging to my Unosculous subclass of *Zoophytes*, I propose to arrange in an order called *Noditentacula*, from their tentacles being furnished with nodi, small knots or projections. Such minute processes, without the aid of a very good microscope, and in a clear, strong, and equalized light, may very easily deceive the eye of the observer. And I may remark, that my proposed order corresponds with a part of Dr. A. Farre's *Polypi Nudibrachiati*; but here it will be evident that this term is inapplicable to those Zoophytes whose tentacula or brachia are rough with small knots or nodules, and are furnished with irregular hairlike projections according to the observations of M. Trembley on the *Hydræ*, and of Mr. Lister on the *Sertulariæ*.

† It is the *Halodactylus diaphanus* of Farre; the *Alcyonidium gelatinosum* of Johnston (Brit. Zooph.); the *Ulva diaphana* and *Alcyonidium diaphanum* of many botanists. It is singular that it should have been so lately classed among plants, for its polypes were long ago mentioned in Solander and Ellis's work on Zoophytes. See also the note of Mr. Gray in his paper on Sponges, at p. 50 of the Zoological Journal, vol. i.

ness I had the pleasure about eighteen months ago to witness the living polypes in that Zoophyte, and to observe for the first time the actual presence of the cilia ranged along their tentacula, and the extremely rapid and vibratory motions of those organs in the water. That author has made known many curious and important facts respecting the Binosculous Ciliotentacular Zoophytes* in his interesting memoir, which is published in the Philosophical Transactions for 1837, where, at p. 412, writing on the gemmules of that species, he says, "It would be impossible to explain the variety of motions which the gemmules are capable of executing, were it not obvious how complete is their control over the action of the cilia, which are their sole locomotive organs. They generally swim with the convex part forwards, and with the greatest rapidity. Sometimes they simply rotate upon their axis, or they tumble over and over; or, selecting a fixed point, they whirl round it in rapid circles, carrying every loose particle after them. Others creep along the bottom of the watch-glass upon one end, and with a waddling gait; but generally after a few hours all motion ceases, and they are found to have attached themselves to the surface of the glass." He further adds, "The parenchyma of the gemmules has a contractile power, somewhat like that of *Hydra*, but less in degree, by which the form of the body is occasionally altered."

* These are the Ciliobrachiate Polypi of Dr. A. Farre. I have long considered the tentacles (*tentacula*) of Zoophytes as presenting the principal and most characteristic organs by which those animals ought to be classified in strict accordance with their natural conformation. The *Ciliotentacula* would include a large and separate order, composed of the genera *Flustra*, *Cellularia*, &c. The *Pinnitentacula* would comprise those Zoophytes whose tentacula are pinnated; for instance in the *Gorgoniæ*, *Pennatulæ*, &c., where the tentacles are furnished with small pinnæ. The *Tubitentacula*, the *Actiniæ*, the *Madreporæ*, and the rest which possess tentacula in the form of siphons or hollow tubes perforated at their extremities. The *Planitentacula*, which is synonymous with a part of Dr. Farre's Nudibrachiate Polypi, would comprehend those Zoophytes whose tentacles are quite plain and devoid of any lateral excrescences or appendages, as *Tubularia*, *Coryne*, &c.; and the order *Noditentacula*, the genus *Hydra*, and family of the *Sertulariadæ*, which have those organs covered with little knots, nodules, or projections. But the class *Zoophyta* itself should be divided into two subclasses; viz. 1. *Binoscula*, or the Zoophytes that have distinctly two holes or orifices, one of which is their mouth, and the other their anus; to this belongs my first order. And 2. *Unoscula*, those with one orifice, serving both for their mouth and anus; herein are supposed to be included all the four latter orders. Additional examinations, indeed, guided by some anatomical skill, are yet wanting for the purpose of completing this tentacular arrangement, which would then be of considerable use in more clearly defining several of the most important characters that belong to those very remarkable animals.

These gemmules with their numerous cilia may be seen, on referring to the drawings that accompany Dr. Farre's paper, in Phil. Trans., plate 26, at figs. 20—23, where they are delineated on an enlarged scale

Dr. Grant has likewise published some observations on the spontaneous motions of the ova of several Zoophytes, well worth perusal, in the Edinb. New Phil. Journ. for 1826, at p. 150 and the following pages*.

Now, by comparing these descriptions with those before given of the germs or sporules of *Ectosperma*, and of the germlike bodies both of the *Spongilla* and of the *Spongiæ*, it will be evident that these gemmules possess far more vigorous and rapid powers of locomotion, arising doubtless from their finlike cilia, and their actions exhibit more volition or a greater degree of spontaneity, and precisely that which usually pertains to animal life: wherefore, they more nearly resemble in those powers the Infusorian Volvox. It likewise appears from those authors, as well as from the earlier accounts of Cavolini, that the gemmules of Zoophytes frequently change their forms in swimming, that they have considerable powers of contraction and dilatation of their whole bodies, and are otherwise highly irritable; hence, in these characters they present an essential difference both from the sporules of the River Sponge, and from the germlike bodies of the Sea Sponges†: but these gemmules, in respect to their irritability alone, much nearer approach the *Infusoria*; and thereby, I think, their animal nature is sufficiently established. Also we know from Dr. Unger's very conclusive experiments, that the locomotive sporules of the *Ectosperma* are those of a true plant; and since the moving germlike bodies of both kinds of Sponge are much more analogous in every respect to those,

* And for that author's account of the ova of *Flustræ*, see the same Journal for 1827, p. 116. I must however object to the term ova (eggs) being used to designate the reproductive bodies (gemmules) of Zoophytes: because, these being enveloped by a mere skin or membrane, usually furnished with cilia, endowed with irritability or powers of contraction and dilatation, and frequently, if not always, possessed of some kind of muscular apparatus, are rendered totally distinct from any ova or ovula, *i. e.* such reproductive bodies as are simply inclosed within unorganized coverings or plain external shells. Although Dr. Allan Thomson incorrectly considers the distinction between eggs and gemmules to be somewhat arbitrary. Vide note at p. 46 of Johnston's Brit. Zooph.

† Dr. Grant positively asserts the ova of the Sea Sponges " do not change their forms while swimming,' (p. 154, *loc. cit.*) And I have not witnessed either any such changes, or any symptoms of irritability, in the sporules of the River Sponge.

than either to the locomotive gemmules of Zoophytes, or to the Volvoces* themselves, we may justly conclude that the sporules of the Sponges are of a vegetable nature.

Furthermore, I consider that those hairlike, vibratory, and minute appendages called cilia, as instruments of locomotion, acting somewhat after the manner of little oars or fins, are peculiar to animals and to animal substances, and that they never can exist upon any vegetable† production whatever. Grant, Dalyell, Farre, Johnston, and others, describe the gemmules of Zoophytes as being furnished with these cilia, and that by them alone they are impelled through the water. The body of the *Volvox globator* is likewise covered with similar organs according to Professor Ehrenberg, who has besides discovered that the cilia of the *Infusoria* have extremely small muscles attached to their roots, by which the vibratory motions are performed. Those naturalists, then, who reason solely from analogy, would, from the similar movements of the sporules of the *Ectosperma* and Sponges, at once decide that all those sporules move by the same means by which the Infusorians and the gemmules of the Zoophytes do, and consequently, that they have such cilia. But here analogy is of no assistance: for these organs of locomotion have never yet been discovered on any vegetable body, although sought for with the aid of very powerful magnifiers. M. Donné very recently, in endeavouring to ascertain the cause of the circulation in the *Chara*, pressed out from a tube of the *Chara hispida* a great number of granules; amongst these were seen some which had a rotatory movement, more or less rapid, independent of the movement of general circulation: some turned round on themselves without changing place: others were carried along by the current, but still preserving their spontaneous rotatory movement. He supposed that they possessed cilia as organs of their motions, but records, "I examined if there existed vibra-

* Recent microscopic examinations of some of the *Infusoria*, (among others) of *Monas lens*, *Kolpoda cucullus*, *Brachionus ovalis*, &c. have shown to me, that in addition to the characteristic distinctions pointed out in the text, these animalcula plainly differ from the locomotive sporules of the *Spongilla* by their great restlessness, and by their being almost constantly engaged in searching for, or hunting after, their food or prey.—J. H., Feb. 12, 1839.

† Of course, I need scarcely observe, those fine hairs or fringes, which are named cilia by botanists, and occurring on different vegetable substances, are perfectly distinct.

tory hairs on the surface of the granules endowed with the spontaneous movement which I have just described, but was not able to discover any, although I employed a power of 500 diameters with a good light*." Similar granules of the *Chara* are represented in tab. 10. in Act. Acad. Nat. Curios. vol. xiii., for the purpose of illustrating Dr. Agardh's memoir "On the Anatomy and Circulation of the *Chara*," "Über die Anatomie und den Kreislauf der Charen." Thus do these granules afford additional analogy in their spontaneous movements to the sporules of the *Ectosperma* and of the *Spongilla* and *Spongiæ*. Since M. Donné has not succeeded in finding any cilia on the moving granules of the *Chara hispida*, and I have before shown that the sporules of the *Spongilla fluviatilis* are entirely devoid of them, though whether they exist on those of the *Ectosperma clavata* I am not aware, but I apprehend they do not: and most assuredly they do not, if those organs vibrate by the sole aid of a muscular† apparatus, which, I conceive, will on further investigations prove to be generally the case; and hence the impossibility of such cilia ever belonging to vegetable bodies. With this view, then, of those singular organs of locomotion, I have also stated the likelihood of those currents, which have been noticed flowing from the moving sporules of the Sea Sponges, when examined under the power of 400 or 500 diameters of the best microscope, turning out to be caused by some other agency than that of real cilia. Such an agency, which I have before observed likely to be sufficiently effective, is that constituted by the endosmosis and exosmosis of different fluids, according to the beautiful discoveries of M. Dutrochet. Though I should remark, that the thin membranes forming the coverings or envelopes of the sporules and granules of plants are quite porous enough to allow the endosmose and exosmose fluids to act: but where papillæ or any cilia-like tubules exist, these, most possibly being hollow, will I think assist the action of those fluids, and so increase the currents by which locomotion is supposed to take place. And this agency, I conclude, will probably be found general in

* See M. Donné on the Cause of the Circulation of the *Chara*, p. 153, in the Lond. and Edinb. Phil. Mag. for August, 1838.

† Dr. A. Farre mentions "muscular lobes" as being present in the gemmules of the *Alcyonium gelatinosum*, which are endowed with true cilia.

causing all those temporary, and apparently spontaneous, movements both in the seeds or sporules*, and in the granules of vegetables.

Wherefore it is manifest, that the very similar movements of the sporules belonging to many water-plants, and of the gemmules of Zoophytes, are not effected by the same means; yet, nevertheless, the design and object of such movements are without doubt the same, namely, a proper dispersion of the different species throughout "the waters of the deep," and thus evincing a no less wonderful than a beneficent mark of an Allwise Power, in providing for the continuation and safe increase of even the most minute objects of created being.

Again, let me proceed to enumerate to you certain other facts which have come under my observation tending to prove the vegetable nature of the *Spongilla fluviatilis*.

The first, that I must mention, is the resemblance of the membrane which clothes the soft portion or jelly, and entirely lines the pores and canals of that Sponge, with that of the leaves of plants; this membrane or cuticle is extremely thin, delicate, transparent, and colourless, and seemed under the microscope which I used as if most finely reticulated. I examined with care the membranes of the leaves of many common plants, amongst which were the daisy, cabbage, stock, primrose, lettuce, geranium, spinach, and thick-leaved saxifrage, and to me their general similarity of appearance both in texture and in transparency with the membrane of the *Spongilla* was obvious. Though whether the delicate membrane of the latter be cellular, as Amici states is the case with that of leaves, or merely porous, or not, I have been as yet unable to discover by reason of my not having at hand a sufficiently high magnifying power†.

M. Dutrochet has described in the valuable memoir before quoted, the

* It is not unlikely that a number more of the seeds both of freshwater plants (*Hydrophyta*) and of marine plants (*Thalassiophyta*) will hereafter be discovered to possess, for a short time, the like locomotive property.

† I suspect, however, that if this membrane of the *Spongilla* were examined under a more powerful microscope, it will be found to possess a minuter resemblance with the external membrane of the leaves or fronds of the *Fuci*.

curious manner in which this diaphanous membrane is often puffed up, or swells out from the surface of the gelatinous substance which it envelopes, into little cones or roundish protuberances, as well as the manner in which these latter are sometimes seen to burst or become pierced at their summit, and to vomit forth a continuous stream of water. And the mode in which I have observed the River Sponge grow and extend itself is owing to this membrane, namely, by its transparent edges gradually progressing over the stone or whatever body it is attached to; and so by the bulging out and rising up of the same membrane, the variously formed lobes and the irregular eminences upon its surface originate and increase in size. The same author has likewise attributed the increase of the Lake Sponge to the like membrane; for he says, "Elle forme une expansion membraneuse qui s'accroît par ses bords de la même manière que certaines Ulves*."

The second, is the gelatinous or soft portion itself covered by that membrane, which when magnified appears of much the same nature as that contained within the membrane of the more fleshy kinds of leaves, and which may be called the parenchymatous substance; for example, I compared a piece of that Sponge with a portion of the leaves of *Crassula coccinea, Hoya carnosa*, several of the *Mesembryanthema*, *Semperviva*, *Cacti* particularly of *Cactus truncatus, Stapelia variegata*, &c.; and placing one next to the other on the glass under the microscope, I could distinctly perceive that the pulpy or gelatinous material of the *Spongilla* resembled the parenchymatous substance of those leaves, and appeared to be principally composed of numerous pellucid globules.

The third, the green chromule or colouring matter which is contained in these globules, and seems to be nearly the same with that of the more fleshy leaves of plants; indeed, when squeezed on a piece of white paper, it stains it of a green or yellowish-green colour according as the specimen of the Sponge itself is of a dark or light green. I have brought this evening for inspection a sheet of white paper, on which I have pressed out the green chromules from the leaves of several phænogamous plants for the sake of comparing them with the similar green matter from that Sponge, as well as some chromules of different colours squeezed from the petals of certain flowers: all these it will

* See Annales des Sc. Nat., tom. xv. p. 212.

be seen dye the paper with permanent colours exactly after the same manner as the green chromule of the *Spongilla* has done. But in order to let the resemblance be more conspicuous, I have also stained the paper (on the left side) with the chromule from the leaf of *Primula Sinensis*, the chromule of a common *Conferva*, and that of *Chara vulgaris*; and having placed these beside the stain derived from the colouring material of the River Sponge, every one must be immediately struck with the similitude of their tints. In fact, the chromule of the *Conferva* appears almost identical in colour with that of the *Spongilla*.

The fourth: if a green piece of this Sponge and any common leaves be steeped in strong acid, the effects are likewise to all appearance very similar. For instance, I took a living piece of the River Sponge of a bright green colour, drained off the water, and poured some muriatic acid over it; at first a little effervescence took place over the whole surface of the specimen in consequence of some calcareous matter having been deposited from the water upon it; next, the action of the acid began to dispel the green and to turn it to a rusty or iron colour*, like as it does when applied to the green of fresh leaves. The specimen then became very soft and pulpy, and losing its form, put on after a further maceration the same appearance as that which arises from a similar effect of muriatic acid upon the parenchymatous substance and chromule of any green leaf.

And the fifth, relates to the disengaging of gas, in all probability oxygen. Whilst engaged in my experiments on the action of light upon the colour of the *Spongilla*, I repeatedly observed those living specimens when placed in

* As it is a well-known property in Chemistry, that the most common and powerful acids change the blue colour of vegetables to red. If, therefore, such an acid be applied to the colouring matter of the Blue Sponge (*Spongia cærulea*), and the colour should thereby be converted to red, this would go far in deciding the vegetability of that marine species. As also, alkalies mixed with blue vegetable juices turn them green, it may easily be proved whether that change takes place in the colour of the same Blue Sponge under the influence of an alkali. And I will merely mention, that it would be interesting to try the effects of acids and alkalies upon the colours of the Red-wine Sponge (*S. vinosa*), and of the beautiful Coral-red Sponge (*S. corallina*), and thereby likewise determine whether the reds be not of a vegetable nature. In addition to these Sponges, other species of a purple and violet, and of a reddish, rose-coloured and pink, are to be found on the coasts of the Mediterranean in the vicinity of Nice, as we learn from M. A. Risso's "Hist. Nat. des principales Productions de l'Europe Méridionale," tom. v. Paris, 1826.

the bright and powerful rays of the sun, and while they were daily increasing in their green tints, to be covered with a great number of bubbles; thinking, however, that they were only air-bubbles escaping from some insect, or some molluscous animal or other, which so frequently lurks within the canals of the Sponge, I carefully chose two or three fresh specimens that were entirely free from any parasitical animal; I placed them in a dish of water, which was frequently changed, and submitted them to the direct action of the light of the sun, by allowing the brightest rays to enter through a glass window and to fall directly upon them; every day bubbles of gas continued to be disengaged from these Sponges, but only in any considerable quantity when exposed to the most luminous sunshine. Because plants in the solar light usually evolve oxygen, which is principally derived from the decomposition of carbonic acid gas. I therefore naturally conceived that these bubbles of gas were most likely mere bubbles of oxygen*, which are so commonly given out by all plants when put under water and subjected to the same influence of light, and that they might thus prove, in some measure, confirmatory of my opinion as to the vegetable nature of this Sponge.

But I must make a more particular statement respecting the currents of water that have been noticed flowing into and issuing out from the interior of the *Spongilla*, and which are analogous to those described by Professor Grant and other authors, as constantly occurring in the *Spongiæ Marinæ*, and esteemed by them the strongest evidences of their supposed animality. These currents I have repeatedly observed in most living masses of the River Sponge, and have proved their actual presence in various ways. My attention was

* Since plants absorb carbonic acid gas, and exhale oxygen: but, on the contrary, animals absorb oxygen and give out carbonic acid gas; if these bubbles on the application of a proper test were proved to be oxygen gas, this would fairly be conclusive of the *Spongilla fluviatilis* being a plant. Though, on the other hand, if these bubbles be chemically found nitrogen (azote), this would not decide the present species to be an animal, because it has been lately shown (by Dr. Daubeny in the Phil. Trans. for 1836, and still more recently by Mr. Rigg in the Phil. Trans. for 1838,) that even plants, in certain stages and under certain circumstances, not unfrequently evolve nitrogen. And if in such case we can determine by means of chemical tests, that this Sponge actually decomposes carbonic acid gas under the influence of solar light, we should then have arrived at a safe conclusion respecting its vegetability. Surely similar chemical experiments might be instituted to demonstrate the true nature of the Marine Sponges. During the time I was making the experiments detailed in the text I had no opportunity of proving these questions.

first called to them by seeing some little extraneous substances floating in the water and being carried by the stream setting in directly to a particular part of the Sponge. With a good magnifier I then clearly perceived not only this current in action, but likewise another flowing from the canals through their large orifices or oscules, and bearing along with it small ejectamenta or brownish bits of the Sponge or of soil, which I frequently observed turning over and over, and sometimes kept by the currents in a revolving motion within the oscules, and thereby undoubtedly showing that certain flowings or streams were taking place in the water. I have further established the presence of them by putting a fresh specimen of the *Spongilla fluviatilis* in a dish of water and sprinkling a little calcined magnesia on the surface; this powder soon exhibited motions, and betrayed by its being carried round and round upon the water in different directions, that strong and distinct currents were actively going on. After many minute examinations in endeavouring to solve the cause of these phænomena, I have hitherto invariably found a worm or an insect, or some crustaceous or molluscous animal, concealed within the Sponge, and by which the currents were actually produced.

A parasitical insect*, indeed, which I have seldom failed to observe lurk-

* Mr. Westwood, F.L.S., having more fully described this curious insect in a letter dated November 30th, 1838, with which he kindly favoured me, I will add the following interesting account from it: "The insects you have sent me are as anomalous as the production they inhabit. From their small size, soft texture, six long legs, and green colour, they have much the appearance of small wingless Aphides; but this is only in appearance. On examining them under a lens, they are seen to be 13-jointed, of an elongated oval form, clothed at the sides, and especially at the extremity of the body, with very long setæ, which are also found sparingly upon the legs. The latter organs are not those of a perfectly organized imago, for they resemble those of the immature *Coccidæ*, or rather the legs of the larvæ of the *Hemerobii*, &c. The antennæ are nearly half the length of the body, very slender, arising from an incrassated basal joint, and apparently very indistinctly articulated. The mouth consists only of four exceedingly fine setæ, as long as the antennæ, between which they are constantly porrected, arising in pairs at a short distance apart. The underside of the body, or at least some of the terminal segments are furnished with elongated, flattened, membranous appendages; which, from analogy with some of the aquatic Neuropterous and Trichopterous larvæ, are evidently false gills, and employed in respiration. From the characters, and with the materials I now possess, it is impossible to decide upon the real nature of these little animals: neither is it possible to decide whether they are in the larva or imago state. There are some imagines amongst the *Aphidæ*, *Coccidæ*, and some other groups, which never gain wings, but always retain their larvalike form; and in the *Coccidæ* we have a mouth composed of four elongated setæ, as I have discovered; but then these

ing within the cells or canals of this kind of Sponge, is one, I believe, at present unknown, and one of a very remarkable form and character. It is in appearance not unlike a wingless *Aphis*; it varies somewhat in size, probably according to its age; is apterous and of a green colour, much resembling that of the Sponge itself, but is occasionally rather more marked with brown. It seems to inhabit this Freshwater Sponge alone, for I do not recollect to have noticed it in any other production; it burrows in it, feeds upon it, eating away large pieces of it; coming forth from its hole, it is often seen walking over the surface of the mass, and retreats, particularly when disturbed, within the canals again. Possessing on the under part of its body certain membranaceous appendages, which are clearly a sort of branchiæ or gills, it makes use of them for the purpose of breathing. Whilst it effects the function of respiration the insect remains within its hole perfectly still, but only keeps rapidly vibrating these gills or branchial appendages, by means of which currents are produced in the water near to the spot where it is lodged.

To this insect, then, I attribute for the most part those currents which I have observed flowing into, and out from, the pores or canals of the *Spongilla fluviatilis*; or else to the same cause, namely, to the process of respiration being carried on by some molluscan, or insect, hid within and inhabiting that individual specimen; for I have always succeeded in discovering, whenever I have noticed similar currents or streams in the water, the presence either of some parasitical insect, or of some molluscan, upon which the Sponge has grown and afterwards entirely invested. Moreover, I have never yet been able to perceive these currents in any living mass of this Freshwater Sponge

Sponge insects are aquatic and furnished with gills, which no imago that I am acquainted with possesses. If regarded as larvæ, it is difficult to conceive even to what order of insects they belong, the structure of the mouth being unlike every group having aquatic larvæ; in some respects they are allied to the larvæ of the *Hemerobii*, which have long mandibles and maxillæ, but these are all terrestrial. We are too well acquainted also with the larvæ of the *Trichoptera* to regard them as belonging to that order; and in the *Neuroptera* we know the transformations of all the groups. There is, however one anomalous genus, *Acentropus*, of which even the order is doubtful; and as we are ignorant of its early stages, it may possibly belong to that."

Having kept in a basin of fresh water for many days together specimens of the *Spongilla* wherein were some of these insects, and having never observed them even beginning to transform, I am very much inclined to consider that they have attained their perfect state. A short notice of this insect is given in the Mag. Nat. Hist., vol. iii. N. S. p. 200, No. for April, 1839.

that has been entirely free from every sort of parasite. If, however, future investigations shall prove that these currents really do exist in the *Spongilla fluviatilis* independent of the respiration or other function of any strange animal, I should then consider, with M. Dutrochet, that they are most probably caused by an endosmosis and exosmosis of different fluids after the manner of plants, and not by any inspiration and expiration of water, from which we might be led to imagine any, even the most distant, token of animal life. And for the sake of explaining the causes of such currents, I will add the following passage from the very interesting and important observations on the branched or Lake Sponge, by M. Dutrochet, which have been already referred to: "Il me paraît hors de doute que cette expulsion dépend de l'endosmose ou de l'introduction continuelle de l'eau ambiante dans les cavités de la Spongille, cavités remplies d'un fluide organique plus dense que cette eau ambiante: cette eau, sans cesse affluente dans l'intérieur du tissu de la Spongille, chasse l'eau précédemment introduite. Ces deux mouvemens contraires d'introduction et d'expulsion d'absorption et d'exhalation, ont lieu d'une manière peu sensible lorsque les conduits d'expulsion dont il est ici question n'existent point, ce qui arrive souvent: alors, en examinant à la loupe l'eau dans laquelle est plongée la Spongille, on observe que les corps très-légers qui sont tenus en suspension par l'eau éprouvent un mouvement faible, mais continuel, dans le voisinage de la Spongille; cela prouve que cette dernière produit dans l'eau des courans imperceptibles, mais non interrompus; ces courans deviennent perceptibles quand existent les conduits membrano-tubuleux qui vomissent continuellement de l'eau. Il est évident que ces conduits offrant à l'eau qui cherche à sortir de la Spongille une issue large et libre, ce fluide s'y précipite et sort en masse par cette ouverture, au lieu de filtrer lentement au travers de la membrane enveloppante*."

Yet it would seem that, that author has witnessed similar currents taking place without interruption in that species, when no crustacean (or other animal perhaps) has been detected within it. He says, "Ayant isolé, dans un petit vase rempli d'eau très-pure, un fragment de Spongille qui n'offrait aucune de ces protubérances membraneuses, j'y vis dès le lendemain naître une de ces protubérances; elle grandit peu à peu, et le deuxième jour elle se perça à son

* Annales des Sciences Naturelles, tom. xv. pp. 215, 216.

sommet, et dès-lors elle vomit de l'eau sans interruption. Le fragment de Spongille n'avait que trois à quatre lignes dans toutes ses dimensions; il me fut facile d'en explorer toutes les parties à la loupe, en le réduisant en petits fragmens, et je n'y trouvai pas un seul *Entomostracé*. Ainsi il me fut démontré que l'eau est chassée hors de la Spongille par une force propre à cet être vivant lui-même*."

Wherefore, supposing that the same phænomena occur likewise in the River Sponge, in the absence of every parasitical animal, I am by no means sure that the endosmose current would enter solely by the pores of that substance, and the expelled or exosmose fluid would issue from the oscules alone, in strict analogy with the flowings of the like currents, which Dr. Grant has described as continually and regularly going on in those Sea Sponges† which he had examined. And in this opinion the former justly celebrated observer appears to coincide, as we learn from the following accurate remarks: "Quelque attention que j'aie apportée à l'observation, il m'a été impossible d'apercevoir par où cette eau, sans cesse expulsée, s'introduisait dans l'intérieur de la Spongille, en sorte qu'il me paraît certain que cette eau est introduite insensiblement par l'absorption que la Spongille exerce par toute l'étendue de sa surface. Au reste, il est bon de faire observer que ces petites protubérances, qui vomissent de l'eau, n'existent pas toujours; j'ai vu des Spongilles qui n'en offraient pas une seule; elles me paraissent donc être des productions accidentelles, et j'attribue leur formation à l'effort que fait l'eau contenue dans l'intérieur de la Spongille pour en sortir. La membrane enveloppante, se trouvant faible en certains endroits, s'y laisse distendre, et forme alors des protubérances au de petites vessies qui se crèvent à leur sommet pour laisser échapper en jet continu l'eau qui, sans cet accident, serait echappée d'une manière insensible et par filtration au travers des parois de la membrane enveloppante. L'expulsion continuelle de l'eau prouve son introduction également continuelle par l'absorption insensible; par conséquent, lorsqu'il n'existe point pour l'eau introduite de voie d'expulsion en masse, elle doit être expulsée d'une manière insensible, c'est-à-dire de la même manière qu'elle est introduite‡."

Now the large holes or openings observable in the surface of the Freshwater

* *Loc. cit.* p. 209. † See Grant's accounts in Edinb. Phil. Journ., vol. xiii. p. 105—107.

‡ Annales des Sciences Naturelles, tom. xv. pp. 209, 210.

Sponge, which constitute the mouths or entrances to the wider passages or canals formed in that structure by the anastomosing fibres, and which are precisely similar to those seen in a number of the Marine Sponges, and have been named by Dr. Grant the fæcal orifices, I have here called oscules (*oscula*), —a term previously used by Ellis and Solander and by Pallas to designate them,—because I consider the *Spongillæ*, being vegetable productions, cannot possibly have any fæces to discharge. Although the ejectamenta, or little pieces of soil before alluded to, are principally the fæces not of the *Spongilla*, but of certain animals parasitically nestling within it: these have been also mentioned by Dutrochet, and described by him as " des fragmens de la matière caséïforme:" they are usually of a brownish colour, and are conveyed from the canals with the expelled current of water. On placing a living specimen of the *Spongilla* as naturally attached to a stone, or piece of wood, &c. in a basin of pure water, these ejectamenta may be in a little time perceived freshly washed out of the canals, and resting on the surface about its oscules. They are most conspicuous on looking at the Sponge in the morning (having on the previous night changed the water), when the whole specimen is generally covered by them, and is rendered quite dirty and discoloured. Washing the Sponge, by letting some fresh water run over it, I again noticed after a few hours more the same appearances. And on examining the specimen, I discovered the presence of some insect or other animal, and found that these ejectamenta were partly its excrementitious discharges, and partly bits of broken fibres, and particles of the Sponge, which were loosened by the gnawing or burrowing of the same creature. I never observed these ejectamenta upon any fresh specimen wherein I was unable to detect any strange animal. Much the same sort of brownish excrement I have seen as emitted by the numerous polypes of *Plumatella repens**, when I have kept them in a glass vessel filled with water for the purpose of studying their habits and organization.

Now, as to the fancied irritability, or powers of contraction and dilatation of this species of *Spongilla*, numerous experiments have convinced me that they

* The like experiment of scattering some magnesia powder on the surface of the water wherein is contained a little colony of these Zoophytes, will demonstrate, in the same way, that eddies and currents are in powerful action whenever any of the minute polypes have protruded themselves from their membranous dwellings. See *antè*, p. 390.

positively do not exist. I have applied several of the same tests to it as Dr. Grant tried on the Sea Sponges*, and with exactly the same results. I have gently touched, raised up, and punctured with blunt and sharp instruments, the delicate membrane, the terminal fibres, the jelly, and the edges of the oscules: I have not only touched, but pierced them with a red-hot needle, nipped and torn them with a forceps, and have conveyed drops of muriatic acid both upon and into them, without the least success. So also M. Dutrochet† assures us, that he could not perceive any sign of irritability in the Lake Sponge, even when under the influence of stimuli. Yet, M. Dujardin very recently observing pieces or small parcels of the latter species of *Spongilla*, "se mouvoir sur le porte-objet du microscope, en émettant des expansions arrondies et des prolongemens plus ou moins effilés, comme les *Amibes*‡; aussi quelques-unes de ces parcelles se mouvoir d'une autre manière, en agitant des filamens très longs d'une ténuitè extrême" (p. 7.), announced these facts, "des expansions contractiles§ et des mouvemens de reptation," as sufficiently demonstrating the animal nature of Sponges. But in this author's paper, intitled "Observations sur les Eponges et en particulier sur la Spongille ou Eponge d'eau douce" (*Spongilla lacustris*), and just published in the "Annales des Sciences Naturelles," Seconde Série, tom. x. *Zoologie*, 1838, I am unable to discover any single fact which can be brought forward as fully proving the animality of either the Freshwater or the Sea Sponges‖; on the contrary, I can find nothing but what may be equally advanced in favour of their vegetability.

* See Edinb. Phil. Journ., vol. xiii. p. 340.

† See Annales des Sciences Naturelles, tom. xv. pp. 210, 217.

‡ This is the Infusorian *Proteus*. I was not aware that Dr. Ehrenberg had already bestowed the new name of *Amœba* on that genus when I proposed that of *Thetis* for it. See my short communication in the Mag. Nat. Hist. vol. ii. N. S., p. 53.

§ I have lately read in the "Revue Zoologique par la Société Cuvierienne,' (Paris, 1838, No. 9, for last September, p. 204,) that M. Laurent esteems, as M. Dujardin does, the *Spongillæ* to be true animals endowed with slow contractile movements.

‖ In the above-cited paper (p. 5.), M. Dujardin calls the *Cliona celata* a *Spongiaire*, which it certainly is not, because Dr. Grant has himself not only seen but has also described its extraordinarily minute polypes. (See Edinb. New Phil. Journ. for 1826, p. 80; and Johnston's Brit. Zooph., p. 305.) It is therefore a true Zoophyte, and what I may name, agreeably to the modern French nomenclature, an *Alcyonidiaire*, being most allied to the genus *Alcyonidium* of Dr. Johnston.

In the first place, as to the peculiar motion of sliding or creeping exhibited by pieces of the *Spongilla* in the water, I have no doubt that much the same may be seen on detaching portions of some plants belonging to the *Ulvæ*, *Fuci*, &c., when placed in that fluid, and that it arises from some other cause than, that of such contractile and expansive powers as are known to pertain to animal life. Indeed portions of some *Fuci*, especially of the leaves or fronds of *Fucus vesiculosus*, *F. serratus*, &c., I have been distinctly informed, on being torn from the original plant and put into water, show their edges rolling up and forming what might be esteemed by some as a sort of contraction, and in other respects varying and altering their newly-divided margins. And in corroboration of this statement, I will here add these appropriate words of Dr. Johnston: "I may remark on these experiments (of Dujardin), that locomotion is no proof of animality. Several *Algæ* are locomotive*."

Now these changes in form of small parcels of the Lake Sponge are accounted for by M. Dutrochet, by a "mouvement de transport des globules élémentaires d'un lieu dans le lieu voisin; ces globules vésiculaires ne sont point immobiles dans leur adhérence mutuelle; ils se meuvent les uns sur les autres sans quitter leur adhérence par une sorte de glissement, et cela par l'effet d'une force inconnue qui appartient au tissu vivant. C'est une action vitale nouvelle qui joue certainement un des principaux rôles dans le phénomène de l'accroissement en longueur des végétaux, accroissement qui est quelquefois d'une rapidité singulière†."

In the second place, the filaments that M. Dujardin describes as being "flagelliformes très longs d'une ténuité extrême," with which the pieces of *Spongilla lacustris* are externally furnished, evidently appear to me to be either the terminating capillary fibres‡, which I have generally noticed growing beyond the surface of the membrane that envelopes the parenchymatous jelly in the River Sponge, or else some species of a Cryptogamic plant, such as a *Conferva*, or an *Oscillatoria*, &c., which has parasitically grown upon that substance; for I have constantly observed a Conferva-like plant with long,

* Compare Johnston's Brit. Zooph., p. 325.

† See Annales des Sciences Naturelles, tom. xv. pp. 214, 215.

‡ These will, I conclude, readily explain what M. de Lamarck means by "subpiliferis" and "pilifères," in his description of the *Spongilla*. See Anim. sans Vert., tom. ii. p. 98, edit. 1816.

thin, diaphanous, and colourless filaments, to spring from the surface of the *Spongilla fluviatilis*, when kept even in fresh water, and to increase in length. This latter fact I consider as the better accounting for the presence of those filaments; and I entertain in my own mind little, if any, doubt that the filaments of the *Conferva* (or *Oscillatoria* probably) which I have so repeatedly examined under the microscope, and seen attached so often to that Sponge, are in reality the "filamens flagelliformes" spoken of by Dujardin, and that the motions of that *Conferva* or *Oscillatoria* in the liquid, easily and most naturally explain the cause of "les filamens agités sur le contour de certains fragmens" of the *Spongilla lacustris*. Wherefore I think no analogy can be drawn from these filaments, as this author has done in the following passage, "De ces parcelles le plus extérieures sont, en outre, munies de longs filamens flagelliformes, comme les *Monades*, les *Gonium*, les *Volvox*, &c. pour déterminer à la surface le déplacement de l'eau et par suite les courans dans les oscules, d'où résulte un contact plus multiplié de la partie vivante avec le liquide, qui lui fournit des matériaux d'assimilation*," with the organs of motion of those *Infusoria*; because the former do not at all resemble, as far as I can learn from the researches of Dr. Ehrenberg, the latter, which are only cilia or mere setæ, and not what could with any propriety be termed "very long, whiplike filaments, of an extreme slenderness."

And in the third place, I cannot from M. Dujardin's observations understand that the "parcelles amorphes," by a grouping or aggregation of which he supposes the mass of the Sponge itself to be formed, are in any respect more "analogues aux *Amibes*,"—which *Amœbæ*, Ehrenberg tells us, are organized animalcula, possessing at least a mouth and gastric sacs,—than are similar portions of many of the gelatinous structures of the *Algæ*, or even of certain kinds of the *Fungi*.

Moreover, it is clear that no good argument in support of the animality of the *Spongillæ* can be brought forward from their smell; for I have found this, when the specimen is quite fresh and immersed in pure water, to be rather pleasant than otherwise, but on the decay of the gelatinous portion it certainly is powerful and offensive; though I am sure that very much of its disagreeableness arises from the death and putrescence of some parasitical

* See Annales des Sciences Naturelles, Seconde Série (*Zoologie*), tom. x. p. 10.

animal lodged within it. It would therefore be just as erroneous to decide that this substance is of an animal nature merely from its smelling, on drying, somewhat like carrion, as it would be to declare that the *Phallus impudicus* among the *Fungi*, and the flowers of the *Stapelia variegata* amongst the *Phanerogamia*, are both really animals, or, at all events, animal productions; for who, having once experienced the filthy odours given out from both these singular plants, did not instantly recognise their nauseous resemblances with the most fœtid and putrid animal matter?

Likewise, some may perhaps be led to infer the animal nature of the *Spongillæ* from the numerous spicula, which constitute a not unimportant portion of their composition, and considering that they are, if not identical, at least exceedingly analogous with those similar bodies, which are abundant in the structures of some of the Polypiferous *Alcyonia*; but these spicula do by no means afford a sole indication of an animal substance, because many vegetable productions are well known to secrete the like particles, which are termed *raphides** by modern botanists.

Lastly, those naturalists who consider with Montagu† the likelihood of the Freshwater Sponge being the nidus, matrix, or production of some unknown insect or animal, and which surely might even at this day receive some slightly additional weight from my discovery of the anomalous insect here already described‡, I would beg to remind, that my successful experiments of having raised, or grown, young *Spongillæ* from their seedlike sporidia and locomotive sporules, have in the most complete manner negatived such a supposition.

Wherefore, my late researches on the *Spongilla fluviatilis* have at length forced me to secede from my favourite and early opinion concerning its animal nature, and to adopt that of its vegetability: of the correctness of which, the proofs (among others) derived, from the modes in which light acts upon it, as well in bringing out the green colour, as in causing bubbles—most probably oxygen—to be disengaged, when exposed to the full sunshine; from its colouring matter remaining pale and unchanged when kept in the dark; from its sporules or reproductive bodies possessing the faculty of locomotion, like

* These *raphides* are crystalline spicula, and consist most frequently of oxalate of lime. The spicula of the Sponges are composed, either of carbonate of lime, or of silica.

† See Wernerian Memoirs, vol. ii. part 1. p. 77, in note.

‡ See *antè*, pp. 390, 391.

those of the *Ectosperma*; from its germination and subsequent manner of growth being precisely similar to those exhibited by many of the lower plants; from the general resemblance of its transparent membrane or cuticle to that of the leaves of plants; from its jelly or parenchymatous substance being composed of globules; from the chromule contained in them giving a permanent colour to paper; from the effects of acids upon its whole substance, and green colour; from its total want of irritability and sensation; from its not being polypiferous; from possessing no trace of any animal organization; and from its receiving nutriment from the water alone,—have rendered me no longer doubtful.

In conclusion, you will permit me to add a few general remarks on the nature of the *Spongiæ Marinæ*, avoiding at the same time as much repetition of my preceding observations as the subject itself will allow.

Considering that these remarkable substances, which have so long puzzled authors in their endeavours to assign to them a proper station in the classification of the various works or productions of nature, were composed of a fibrous unorganized skeleton, generally strengthened by spicula, and formed by secretion from a soft parenchymatous substance or jelly, which in fact constituted the individual animal; that this animal-jelly was endowed, according to several naturalists, with some slight symptoms of sensation and of contraction and dilatation, and possessed the powers of sucking in and throwing out the sea-water by a sort of inspiration and expiration, I therefore instituted for them an order, which I termed *Gelatinifera**, in purpose to express this view of the animal or live jelly. For in the summers of 1822 and 1823 many observations on some specimens of *Spongia oculata* and *S. urens*, in their native localities on the coast of Durham, convinced me that they were in truth not polypiferous; but I was then unable to prove with any satisfaction to myself the contractile and expansive faculties, which I was

* Dr. Grant has lately placed the Sponges in an order *Porifera*. But I must here observe, that in my "Natural History of the Vicinity of Stockton on Tees," which was written in the spring of 1825, printed in 1826, and published in 1827, I formed my 4th order of *Polyparia* "*Porifera*," to comprise the genera *Cellepora*, *Millepora*, and *Tubulipora*. And I have in a former note stated that my order 8. *Gelatinifera* comprehends the Sponges.

inclined to believe belonged to them, and which the statement made by so high an authority as Baron Cuvier, in his first edition of the *Règne Animal**, induced me partly to acquiesce in. Since the year 1823, I have not had an opportunity of re-examining any of the Sea Sponges in a living state and in their native element. But the subsequent investigations of Professor Grant, and of other observers, have clearly determined that they are not endowed with the least irritability.

Being so wedded to my former opinion of the animality of all Sponges, and being by my researches on the River Sponge at length assured of its vegetability, I then began to imagine, agreeably with the suggestions expressed by Montagu†, De Lamarck‡, and Bell§, that it might possibly be quite a different substance from the Sea Sponges; and if so, these latter might be yet esteemed of a true animal nature‖. However, still more recent and minute comparisons of many of these, as preserved in several collections with the *Spongilla*, have compelled me to abandon that idea; for I cannot find any more solid ground for it, than for holding that one genus of the *Fungi*, as *Merulius*, belongs to a perfectly distinct division of nature, from another genus of the same order, for instance, *Agaricus*; and as all who should behold them would immediately and unhesitatingly acknowledge both the one, and the other, to be a true Mushroom or *Fungus*; so we are equally obliged to admit, that the *Spongia* and *Spongilla* are in fact both real Sponges; indeed there scarcely is even so much as a generic difference between them; and in this, with the earlier naturalists Dr. Fleming¶ coincides, for he places both kinds in one and the same genus, *Halichondria*.

Both the Freshwater and the Sea Sponges are furnished with a skeleton of fibres interlacing, crossing, and anastomosing with themselves; generally also strengthened with those singularly crystallized particles termed spicula; with a parenchymatous soft portion or jelly; with a fine and transparent envelop-

* See tom. iv. p. 88.

† For the observations of Montagu, refer to the Wernerian Memoirs, vol. ii. part 1, p. 76.

‡ Anim. sans Vert., tom. ii. pp. 98, 99, edit. 1816.

§ See Mr. Bell's Remarks on the Animal Nature of Sponges in the Zool. Journ., vol. i. p. 204.

‖ This is alluded to by Dr. Johnston, in his note on the nature of Sponges, at p. 325 of Brit. Zooph.

¶ See History of British Animals, p. 524.

ing membrane*; with numerous minute pores; and frequently with larger orifices or oscules, which are more sparingly and irregularly dispersed over their surfaces; with passages or canals communicating through the pores and oscules one with another, along which the water finds a ready course or circulation, and affords nutriment to all the inner parts of the masses; with locomotive sporules; and in some species with fixed sporidia.

Concerning these last-mentioned bodies, which I have previously supposed to be sporidia, a fuller notice is here requisite.

Although M. De Lamarck† has said of the gelatinous bodies or grains that are so numerous in the *Spongillæ*, "que rien de semblable n'a encore été observé dans les véritables Eponges," yet they have been recently detected in the *Spongiæ Marinæ*; for Professor Link has expressly made known in his essay in the Transactions of the Royal Academy of Sciences at Berlin, that M. Ehrenberg told him, that he had seen them (Sporangien‡) in very many Sponges of the Red Sea. His own words are as follow: "Auch sagt mir Herr Ehrenberg, dass er an mehreren Spongien im Rothen Meere Sporangien bemerkt habe§."

And indeed these seedlike bodies, little spheres, spherules, or sferette, sporangien or sporidia, may be seen well represented in fig. C. at *t. c. t. c.*, and in fig. E. at *a. a. a.*, of Donati's‖ Plate VIII., given to illustrate the marine production called by him "Alcionio primo di Dioscoride," which is synonymous with the *Alcyonium cydonium*¶ of Linnæus**, and *A. cotoneum* of Pallas††:

* As this membrane is subject to some variation, it may be used for a character to distinguish the genera of the *Spongiæ Marinæ*.

† Anim. sans Vert., tom. ii. p. 99, edit. 1816.

‡ It is worth while to note, that Link uses in this passage the same word as he had just before done (at p. 120.) when he was describing the similar seedlike bodies (Sporangien) of the *Spongilla*; no uncertainty can consequently arise about the exactly identical nature of these bodies.

§ Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin, aus dem Jahre 1830. Berl., 1832, p. 121.

‖ See Donati, Storia Naturale Marina dell' Adriatico. Ven., 1750.

¶ The *Alcyonium cydonium* of Müller, which is the *Cydonium Mulleri* of Fleming and Johnston, is a very different substance, being a true Polypary. Yet Ehrenberg deems the *A. cydonium* of Muller to be only a young specimen of *Alcyonium digitatum* of Linnæus; and from the figures 3 and 4 in tab. 81. vol. iii. of the Zoologia Danica, edit. Abildgaard (Havn. 1789), it certainly much resembles the early form of that Zoophyte, and before it has developed itself into the usual fingerlike lobes.

** See Linn. Syst. Nat., edit. 12, p. 1295.

†† Pallas, Elench. Zooph., p. 359.

but which, from its having neither polypes nor stellate pores, I consider to be a species of Sponge and not an *Alcyonium*. In this opinion Ellis, Solander*, and Montagu† were likewise agreed. I will therefore bestow the more appropriate name of *Spongia Cydonia*, or the Quince Sponge, upon this substance of Donati, of Linnæus, and of Pallas.

Should, however, any future doubt be raised with respect to these seedlike bodies (sferette) described by Donati, or should it be hereafter attempted to be shown that the production itself is strictly an *Alcyonium*, this would not in any way invalidate my statement, because the testimony of Dr. Ehrenberg at all events decides the actual existence of sporidia (Sporangien) in certain Sea Sponges‡, and in all probability they, as well as sporules possessing for a short period the locomotive faculty observed by Dr. Grant in several others, will be found at the proper season of the year common to, and more or less abundant in, every species of the *Spongiæ Marinæ*.

Now as to the currents of water: If these do indisputably take place independent of the respiration or other function of any marine insect, or worm, or crustacean, or molluscous§ animal parasitically nestled within the specimen of *Spongia*, I must consider that they are most likely caused by an endosmosis and exosmosis of fluids, in the manner I have already mentioned when describing the analogous currents of the *Spongilla*: and if they always occur in all those *Spongiæ Marinæ* which are furnished with oscules, in the same constant and uniform manner that Professor Grant has informed us they do in a few of the more common species, that is to say, if the endosmose or entering fluid should be always found to flow in by the pores, and the exosmose or expelled one to issue out from the oscules; these facts then would only present an analogy with what is effected in the same regular mode by the sap in the higher plants, where the entering sap rises throughout the plant by one set of ves-

* Ellis and Solander, Zooph., p. 183.

† In Wern. Mem., vol. ii. part 1, p. 118 and p. 69.

‡ Similar sporidia are delineated at *a.* and *b.* of the figs. 1 & 2 in tab. 157. vol. iv. Zoologia Danica (edit. Havniæ, 1806.) They are referred by the editor to a sort of *Alcyonium*, but which I must clearly account as a species of *Spongia*; and in support of my opinion, consult the observation of the learned editor at p. 42 of the same volume.

§ I may just remark that Pliny attributed the presence of Mollusca in the Sea Sponges to a cause the very reverse of the fact; *i. e.* "vivere escâ, manifestò conchæ minutæ in his (Spongiis) repertæ ostendunt." Vide Nat. Hist., lib. ix. cap. 69.

sels, and the returning fluid descends by other and different vessels. Yet I have been told by an excellent naturalist, that a species has been discovered in the Caspian Sea which does not possess any oscules: and according to M. Lamouroux, many more of the Sponges are destitute of them; for he has justly remarked, "Beaucoup d'Eponges sont privées de ces oscules; ainsi leur présence ou leur absence, leur grandeur, leur forme, leur situation, peuvent fournir de bons caractères pour faire des sections ou définir des espèces *."

Wherefore the same important agency of an endosmosis, and a consequent exosmosis, in pursuance of the valuable discoveries of M. Dutrochet, can alone I think account for the existence of these currents under all the circumstances here alluded to. One, if not the chief, use of these continuous currents seems clearly to be, to convey nutritive matter in a liquid state, as mixed or assimilated with the water, to the innermost portions of the Sponge after the like manner in which plants receive their food or nourishment.

Next, the smells or odours which the different Sea Sponges give out in their fresh and dried and burnt † states, resemble far more those of certain vegetables than those of animals, although it is well ascertained that several species have a decided animal smell ‡; so likewise some of the *Algæ* possess a strong putrid odour like decayed animal matter, and which, on the application of certain acids, becomes ammoniacal; hence, then, no proof can be derived from these facts in favour of the supposed animality of the Sponges. And this circumstance has been long ago properly commented upon by M. Lamouroux in these words: "Des zoologistes ont classé les Eponges parmi les animaux, à cause de l'odeur qu'elles répandent fraîches et au sortir de la mer, ou pendant qu'on les brûle. Ce caractère ne peut servir, la majeure partie

* See Lamouroux, Hist. Polyp. Coral. Flex. p. 15.

† In Solander and Ellis's work on Zoophytes, p. 184, it is said of the Common Sponge (*Spongia officinalis*), "When they are first taken out of the sea they have a strong fishy smell; and when the Sponge is burnt the smell soon discovers its animal nature." This latter fact has been constantly copied by most English authors ever since the publication of that work, and has been incorrectly esteemed as a test decisive of the animality of Sponges. See also Montagu's note ‡ at p. 73. vol. ii. part 1. of the Wern. Mem. Again, Montagu has (*op. cit.* p. 76, in note *) observed on the Fresh-water Sponge, that "this fibrous brittle substance is evidently of animal origin by its odour in combustion."

‡ Refer to p. 96 of Edinb. Phil. Journ. vol. xiii.

des plantes marines donnant par l'incinération, des odeurs et des produits analogues à ceux des animaux*." Neither is the presence of ammonia in these substances at all conclusive of their animal nature; for I have before mentioned that some plants contain nitrogen or azote, and from the combination of this ingredient with hydrogen the ammonia itself is formed; wherefore in those vegetables, especially in the lower water-plants, which contain nitrogen, more or less of ammonia is known to be generally produced.

Thus it seems that there really exists no more peculiarity in the chemical composition of Sponges†, than what is also present in that of certain vegetable substances. And for the sake of corroborating this, I will cite the following authority from a naturalist, equally illustrious in botany and in zoology, who, describing Sponges as animals, nevertheless allows, "chymicis etiam principiis paulò similiores plantis deprehenduntur‡."

To me then it is evident, that the Sea Sponges being so perfectly analogous in every part of their structure with the Freshwater Sponges, it is impossible that they can be separated from one and the same natural order, or accounted as the one pertaining to the animal kingdom, and the other to the vegetable. And as I have become convinced that the River Sponge is a true member of the latter, and as I have endeavoured so to demonstrate this in the preceding pages of my present letter, I must now necessarily be compelled to acknowledge myself a convert to the vegetability of the Sea Sponges. In the full confirmation of this, and in the absence of more direct proofs, which may yet be derived from future researches on these marine productions, whilst growing in their native localities, I will concisely sum up in a general manner the following evidence of their want of animal life, or what I may term their non-animality. They have no tentacles, no cilia, no mouth, no œsophagus, no stomach or gastric sac, no gizzard, no alimentary canal, no intestine, no anus, no ovaria, no ova, no muscles or muscular fibres, no nerves or ganglia,

* Hist. des Polyp. Corall. Flex., p. 12.

† But the discovery of iodine in the Sea Sponges determines that they more nearly resemble the *Fuci* in their chemical composition. Consult the article "Iode" at p. 594. tom. xxiii. of the Dictionnaire des Sciences Naturelles (Paris, 1822), which was written by M. Chevreul, Professor of Chemistry.—I only became acquainted with this fact on December 7th, 1839. J. H.

‡ Dr. Pallas in Elench. Zooph., p. 376.

no irritability or powers of contraction and dilatation, no palpitation, and no sensation whatsoever.

Surely, then, we cannot any longer esteem these natural substances to be individual animals, or even groups of animals, in which not one organ, or a single function or property peculiar to an animal can be discovered*! And that they are in fact neither the nidus or matrix, nor the fabrication or production of any animal, the mode in which Professor Grant witnessed their locomotive sporules beginning to germinate, to increase, and to develop themselves after the forms of their parent structures†, must be to all thoroughly satisfactory.

It is to me nevertheless a subject not altogether certain, and one worthy of some consideration, in what order of plants the Sponges ought to be included.

Linnæus, as it will be remembered, in his Flora Lapponica, edit. 1737, and Flora Suecica, edit. 1745, placed the *Spongia lacustris* and *S. fluviatilis* in his class *Cryptogamia*, and order *Lithophyta*; but in the earlier editions of his Genera Plantarum, and of his Species Plantarum, he distributed both the Sea and Freshwater Sponges in his class *Cryptogamia* and order *Algæ*.

In a work of a late date, intitled, "A Natural Arrangement of British Plants," by Mr. S. F. Gray, both the *Spongilla* and the Sea Sponges are classed in the Fam. 2. *Thalassiophyta*, which belongs to his Subseries I. *Plantæ Cellulosæ Aphylleæ*‡.

Professor Link has very recently stated, in the work§ quoted in the beginning of this letter, that they should be separated from the Zoophytes and replaced amongst the *Algæ*. But my own observations lead me to conclude that all the Sponges would be more correctly arranged in an intermediate order between the *Algæ* and the *Fungi*; for although they are with some reason considered by many naturalists to be allied to certain of the *Algæ*‖, still

* So must we at length agree with the illustrious Greek naturalist, that the Sponges resemble plants in every respect: ὁ δὲ σπόγγος, παντελῶς ἔοικε τοῖς φυτοῖς. Aristot. Hist. de Animal. lib. viii. s. 3.

† See Edinb. New Phil. Journ. for 1827, p. 137.

‡ See vol. i. p. 353 of Mr. Gray's work published in 1821.

§ See Annales des Sciences Naturelles, Seconde Série, tom. ii. (*Botanique*), p. 328.

‖ M. Link however (*op. cit.* p. 330.) admits, "il est vrai que la structure des Eponges est très différente de celle des autres *Algues*; mais la structure de ces dernières plantes présente deja des modifications si frappantes qu'on ne doit pas s'étonner d'en rencontrer une de plus."

I think they really present a stronger affinity with many of the *Fungi*, particularly with the more permanent and porous kinds, several of the *Boleti* and *Polypori*, for instance; I therefore propose to classify them as follows.

Natural System.

Class III. ACOTYLEDONES.

Division I. Terrestres.

Nat. Ord. Fungi.

Division II. Aquaticæ.

Seu *Hydrophyta* et *Thalassiophyta*.

Nat. Ord. Spongiæ.

Spongiarum genera; ac *Spongilla*.

Nat. Ord. Algæ.

Linnean System.

Class XXIV. CRYPTOGAMIA.

Ord. 4. Algæ.

Ord. 5. Spongiæ.

Spongilla, et *Spongiarum* genera *Marinarum*.

Ord. 6. Fungi.

Or, indeed, if it be thought upon the whole more advisable and more consistent with the nature of their structures that all the Sponges be included in the heterogeneous order *Algæ*, they should then compose a distinct and separate family, *Spongiaceæ*, and be placed immediately next to the order *Fungi*.

Notwithstanding that our knowledge respecting the nature of Sponges has during the last fifteen years received some advancement, I must express a hope to you that observers, whose leisure and situation on the sea coast* afford

* The difficulty of preserving Sponges, even in bottles filled with rectified spirit of wine, is so great, that no one, who has not the means of examining them in a fresh condition and in their native element, can ever expect to throw much light on their variously-formed structures. The dried masses of fibrous skeletons, devoid of their true natural forms and colours, without their parenchymatous jelly and enveloping membrane, &c., as exhibited in our museums, can but little assist us in obtaining a correct knowledge of their natural history.

them the opportunity, would, from their own researches on these productions, furnish us with more full and accurate details, and thereby lay the foundation for a separate and copious work,—indeed a complete monograph,—on the Sponges; recollecting also the concluding remark of the late Professor Pallas, which is at this day even far from being inapplicable: "Quibus Spongiarum fertiles oceani tractus lustrare contigerit bene multa invenient quæ superaddant et magnum in scientia naturali explebit hiatum, qui plenam Spongiarum historiam dabit, gnaris gratissimam certe futuram atque utilissimis observationibus feracissimam *."

* Elench. Zooph., p. 377.

XXIII. *Illustrations of the Relationships existing amongst Natural Objects, usually termed Affinity and Analogy, selected from the Class of Insects. By* J. O. Westwood, *Esq., F.L.S., &c.*

Read January 17th, and May 2nd, 1837.

In the fourteenth volume of the Transactions of the Linnean Society is contained an interesting paper by the Rev. W. Kirby, with the title, "A Description of some Insects, which appear to exemplify Mr. William S. MacLeay's Doctrine of Affinity and Analogy," wherein the reverend author points out the confusion which has occasionally arisen in attempts made to distribute the objects of nature according to their natural relations, in consequence of the authors of such attempts having no clear perception of the distinctions which exist between the two kinds of relations above mentioned, and therefore confounding them together, or even occasionally giving the higher rank to relations of analogy instead of affinity.

The object of the following remarks is still further to illustrate the theory in question, and to show that from the entirely relative and comparative nature of these relations, founded as they both are upon more or less perfect resemblance, two animals may at the same time be allied together both by affinity and analogy; in other words, two animals may possess totally independent relations both of affinity and analogy: thus, whilst the goatsucker and the swallow are related to each other by analogy when we look to the class of birds alone, we find them related together by affinity when the comparison is made between them both as *birds* with the bat amongst *Mammalia*. In like manner, whilst the bat and the swallow are thus related together by analogy as members of the classes *Aves* and *Mammalia*, they must be considered to be related together by affinity as *vertebrated animals* when we compare them with the dragonfly amongst the *Invertebrata*.

The truly comparative nature of these relations has not been hitherto stated, and hence, as it appears to me, has originated much of the misconception which still exists even among professed naturalists, many of whom are ready to admit the existence of relations amongst natural objects founded upon more or less complete *resemblances*, but yet of equivalent value, without perceiving the various natures, and consequently varied value, of such relations*.

In the following pages I have first selected such species of insects as exhibit an analogy with other species of the same order; and secondly, such as illustrate the analogies between insects of different orders.

That species belonging to two genera of the same family, or even subfamily, may be analogous representatives of each other, is as clear as though they belonged to different families or orders. Thus, although the genus *Adelium*, K. is so excellent an example of analogy, when its species are compared with the species composing the family *Carabidæ*, that the specific names *Caraboides*, *Calosomoides*, *Licinoides*, have been given to insects belonging to the former genus, yet there may be relations of analogy existing among the species of

* One of the chief difficulties connected with this subject is that of drawing the precise line between these two kinds of relations (hence the difficulties connected with the true location of *Mantispa*); this is not a little increased by the evident distinctions existing amongst each class of relations: thus affinities may be so concealed as to escape the eye even of professed naturalists; hence the Homopterous genus *Aleyrodes* so completely puts on the appearance of a moth, that Linnæus named it *Phalæna Tinea proletella*; whilst Fabricius in all his works described an Orthopterous insect (*Hymenotes rhombea*, Westw. Proc. Zool. Soc., 1837, p. 130.) under the Homopterous genus *Membracis*; the precise relations of these insects being *disguised affinities*. The relation between the house- and field-cricket is an *evident* affinity, but that which exists between the field-cricket and the mole-cricket is a *disguised* affinity, and yet no one will question the propriety of these insects being considered as closely allied together, although so totally different in form. Again, analogies may be equally *disguised*. No one, for example, has ever supposed that one of the *Carabidæ* and *Paussus* possessed any relation; and yet not only do *Ozæna* and *Paussus* crepitate, but both also possess a minute tubercle at the posterior external angle of the elytra, which no other Coleopterous insects exhibit. In like manner, no one would suppose that any relation could exist between a butterfly and a woodlouse (beyond that of each being a Condylopodous animal), and yet by comparing the imperfect state of *Thecla* with the perfect state of *Oniscus* we find them to possess a *disguised analogical relation*. I mention these as instances of the many trivial circumstances which may be collected as grounds for asserting the existence of analogical relations, which are necessarily often of so diversified a character and so readily to be traced between almost any given groups, as to lead to a supposition that they can afford no decisive test of a natural arrangement independent of more important considerations.

the Carabideous genera thus analogically represented not less strong. The genus *Carabus*, for instance, comprises species (*Carabus gemmatus*, F.) which in their habit and the peculiar sculpture of their elytra analogically resemble *Calosoma Scrutator*, whilst *Carabus Fabricii*, &c., in the flattened form of the body represent *Licinus*.

In like manner, *Catascopus*, belonging to one of the subfamilies of *Carabidæ*, represents, as Mr. Kirby, in the memoir above referred to, notices, some of the insects composing another subfamily, *Bembidiidæ*; whilst *Masoreus* (a genus nearly allied to *Trechus*), in the posteriorly dilated thoracic lobe, represents *Lebia*, &c.

These Carabideous insects must however be regarded as related together by affinity (as forming part of the same family), when a relation of analogy is endeavoured to be traced between them and the species of other families, as, for instance, between *Carabus* and the Helopideous genus *Adelium*, noticed above.

In order to illustrate the relation of analogy exhibited by an insect belonging to one tribe but possessing the aspect of another, Mr. Kirby, in the memoir above referred to, described a genus under the name of *Pseudomorpha*, of which he says, "that even a practical entomologist, if he chanced to examine a specimen that had lost its antennæ, might at first regard it as a *Nitidula* or *Ips*, F., or as coming near that genus in the system; but when he came to study it in detail he would discover to his surprise all the essential diagnostics of one of Latreille's *Entomophagi*. The characters which give it an air and general appearance unlike those of its tribe are its sessile wide head received into the thorax, and its short antennæ and legs."

For the purpose of completing the illustrations of this curious genus given by Mr. Kirby in the plate accompanying his memoir, I have here added an outline figure of the insect now in the collection of the Entomological Society of London, the original being incorrect in the relative proportions of the legs, and no notice having been taken either in the description or figure of the erect rigid hairs with which the margins of the elytra are clothed. Mr. Kirby indeed describes the eyes as being "in medio pilosi;" but this is not correct, as it is only that part of the skull which borders the underside of the eyes which is furnished with rigid hairs, which extend beyond the middle of the

eyes. I have also given a careful representation of the maxilla and the anterior tibia, showing the peculiar construction of the subapical notch; and have added a figure of the underside of the head with the various organs *in situ*, from which it will be seen that there is a curved elevated line across the middle of the produced central part supporting the mentum, but I very much doubt whether there be any actual articulation at this place. On each side of this central part is a deep impression, having an elevated ridge running down the middle, forming two deep canals on each side, the interior of which serves for the action of the base of the maxilla, whilst the external forms a fossula for the concealment of the antenna when withdrawn beneath the head.

In the "Iconographie des Coléoptères" of Messrs. Dejean and Boisduval (vol. i. p. 176) a genus was proposed under the name of *Axinophorus*, consisting of two species, *A. Lacordairei* and *A. Lecontei*, the former inhabiting the vicinity of Rio Janeiro, and the latter North America. In the Supplement to the Spécies Général, Dejean having ascertained that this new genus was identical with *Pseudomorpha* as well as with the genus *Drepanus*, indicated only by Illiger in the sixth volume of the "Magazin der Entomologie" (p. 344), republished his descriptions of the *Axinophori* under the generic name of *Drepanus*, giving *A. Lecontei* as probably identical with *Pseudomorpha excrucians*, K. On comparing the figure given of *A. Lecontei* in the Iconographie with the authentic specimen of *Pseudomorpha excrucians*, now in the collection of the Entomological Society, it is unquestionable that they are specifically identical, so that the name *Lecontei* must sink into a synonym; and in like manner I feel disposed to preserve the generic name proposed by Mr. Kirby in preference to that merely indicated by Illiger.

In the first part of the Transactions of the Entomological Society, a still more remarkable insect was described by the Rev. F. W. Hope, under the name of *Adelotopus Gyrinoides*, being doubtfully placed in the family *Gyrinidæ*, with the observation: "This singular insect was sent to me from the Swan River Settlement in New Holland. It seems to unite in itself the characters of several families. From the tarsi it is referrible to the *Pentamera*; whilst its general appearance and clavate antennæ place it amongst the *Necrophaga*. By its subcontractile legs (for the bent tibiæ are not en-

tirely concealed within the femora) it is allied to the *Byrrhidæ*; but the leading character afforded by the maxillæ evinces a near affinity with the *Entomophaga*, amongst which the *Gyrinidæ* must be considered the nearest in proximity, *Gyrinus bicolor*, Fab. somewhat approaching this insect in form."

Very ample details were figured of this most extraordinary insect, which certainly presents one of the most interesting instances of analogical relations which have hitherto been published. That such is the case, must be certainly admitted, when the preceding observations upon its relations are considered with reference to its actual affinity, since, notwithstanding its Gyrinoid habit, clavate antennæ, and subretractile legs, I have now ascertained that it unquestionably belongs to the *Carabidæ*, and that it is very closely allied to *Pseudomorpha*, with which it agrees in the peculiar structure of the underside of the head, very short maxillary palpi, hatchet-shaped labial palpi, large femora, slender tibiæ, simple tarsi, &c.*

I should probably have long remained in ignorance of this most unexpected affinity, had it not been for the examination of another curious beetle, also from New Holland, which I purchased from a dealer, and which, having its legs and antennæ retracted, I for a length of time regarded as a *Gyrinus*;

* I am indebted to Mr. Edward Newman, F.L.S., for an opportunity of describing and figuring a new species of the genus *Adelotopus*, of which the following are the characters.

ADELOTOPUS IPSOIDES. W. TAB. XXVIII. fig. 2.

A. rufescenti-piceus; elytris paullò dilutioribus tenuissimè punctatis, genubus subtùs valdè dilatatis, humerisque elytrorum sublævibus.

Long. corp. lin. 3½. Lat. lin. 1½.

Habitat in Australasiâ. (Adelaide.) *A. H. Davis.*

Oblongus, convexus; capite tenuissimè punctato, transverso, genubus subtùs maximis, et (capite suprà viso) valdè prominentibus: *antennæ* breves compressæ, in canali profundo ad basim receptæ. *Palpi* et *antennæ* breves, piceo-rufescentes; *thorax* lateribus subrotundatis, angulis posticis acutis; marginatus; lateribusque anticè paullò recurvis, margine antico punctis minutis valdè approximatis, posticè magis distantibus. *Elytra* tenuè marginata, (versus humeros sublævia,) tenuissimè et irregularitèr punctata. *Pedes* picei, femoribus maximis. *Corpus* subtùs pallidius, rufescenti- aut luteo-piceum, glabrum, nitidum.

I have never met with any Coleopterous insect which exhibited so great a development of the genæ on the underside of the head, here forming a large elevated plate on each side of the mouth between the trophi and the base of the antennæ.

wishing however to investigate my exotic *Gyrinidæ*, I found on examining the underside of the insect that it had slender legs and antennæ; I therefore, still supposing that my insect must be one of the *Hydradephaga*, immediately regarded it as a species of *Colymbetes*; but a little further examination showed me that the legs were neither ciliated nor fitted for swimming. I therefore determined to investigate the structure of the mouth, when I discovered that I had obtained another Carabideous insect, also very closely allied to *Pseudomorpha*, which had not only deceived myself, but several excellent entomologists. The following are its characters.

Sphallomorpha.

Corpus breve, latum, depressum, oblongo-subquadratum, thoracis elytrorumque lateribus continuis.

Caput transversum, depressum, thoraci ad oculos immersum. *Oculi* sat magni, laterales. *Labrum* transversum, breve, anticè ferè rectum, angulis anticis rotundatis. *Mandibulæ* forcipatæ, breves, subtrigonæ, intùs edentatæ, basi intùs in lobum magnum rotundatum producto. *Maxillæ* parvæ, lobo interno incurvo, intùs setis rigidis instructo, externo palpiformi biarticulato, articulo 1mo brevi, 2do ante apicem paullò crassiori, apice ipso truncato. *Palpi maxillares* maxillâ breviores, incrassati, cylindrici, 4-articulati, articulo 1mo brevissimo, ut vix distinguendo, 2ndo magno subconico, reliquis duobus sensim tenuioribus, extimo præcedente paullò longiori, apice obliquè truncato. *Mentum* basi haud articulatum (lineâ indistinctâ locum articuli occupanti), breve, transversum, angulis lateralibus anticè in lobos duos ferè parallelos productis, dente nullo medio. *Labium* ultra lobos menti haud extensum. *Palpi labiales* brevissimi, scapo basali inserti, 3-articulati, articulis duobus basalibus brevibus, ultimo longiori compresso, et apicem versus paullò crassiori (minimè securiformi), apice obliquè truncato. *Jugulum* elongatum, basi mento angustius, apice latiori, angulis anticis setâ instructis, fossulâ profundâ utrinque pro receptione maxillarum, alterâque inter hanc et oculum pro receptione antennarum. *Antennæ* capite ferè duplò longiores, gracillimæ, 11-articulatæ, articulo 1mo incrassato subarcuato, 2ndo cæteris breviori, reliquis æqualibus.

Thorax transversus, anticè angustior, posticè elytrorum baseos latitudine, sinu lato antico pro receptione capitis, margine postico ferè rectè truncato angulis anticis acutis, posticis subrotundatis; marginibus lateralibus rotundatis, tenuissimè marginatis: prosternum inter pedes anticos acutè protensum: metasternum breve. *Scutellum* parvum, subtriangulare. *Elytra* oblongo-subquadrata, depressa, posticè paullò angustiora, basi thoracis partis posticæ latitudine, et ad eum arctè applicatâ, tenuissimè marginata, apicibus obliquè subtruncatis, abdominis apicem haud tegentibus. *Pedes* breves, femoribus magnis, ovatis, compressis, subtùs (pro receptione tibiarum) carinatis, tibiis gracilibus, anticis intùs apicem versus emarginatis, tarsis subsetaceis, articulis simplicibus, anticis subtùs (in uno sexu saltem) serie duplici pulvillorum minutissimorum; unguibus duobus.

Spec. 1. Sphallomorpha decipiens.

Nigra, lævis, subnitida; ore, antennis pedibusque luteo-piceis, thoracis elytrorumque limbo tenui-luteo.

Long. corp. 4 lin.

Habitat in Novâ Hollandiâ.

In Mus. nostr.

Hoc genus a *Pseudomorphâ* differt habitu latiori et magis depresso, et præsertim structurâ juguli, menti et palporum labialium, atque ab *Adelotopo* antennis filiformibus, mento et palpis.

I am further enabled by the kindness of the Rev. F. W. Hope to add to the interest of this communication by the introduction of a figure and description of another New Holland insect, which in some respects appears to be intermediate between *Pseudomorpha* and *Sphallomorpha*, and of which the following are the characters.

Silphomorpha.

Corpus oblongo-ovatum, subdepressum; thoracis elytrorumque lateribus subcontinuis, subreflexo-marginatis.

Caput, *antennæ*, *mandibulæ*, *maxillæ*, et *palpi maxillares* fere ut in *Sphallomorpha*. *Labrum* latum, breve, margine antico in medio parùm emar-

ginato 4-setigero. *Mentum* maximum, cum jugulo adeò connexum, ut vestigium nullum articuli videas, angulis basalibus 4-setosis, lateribus dilatatis, angulis anticis in lobos duos magnos obtusos productis, denteque medio obtuso abbreviato. *Labium* ultra apicem loborum menti productum. *Palpi labiales* quàm in *Pseudomorphâ* paullò longiores, triarticulati, articulis duobus terminalibus, subæqualibus, ultimo compresso apicem versus latiori, obliquè truncato, subsecuriformi. *Antennæ* gracillimæ, dum quiescentes in fossulâ ad latera menti receptæ. *Thorax* ferè ut in *Sphallomorphâ*, lateribus magis rotundatis, et angulis posticis minùs acutis, subindè margo lateralis thoracis et elytrorum minùs continuus evadit. *Elytra* obovata, quadrata, depressa, ad apicem obliquè subtruncata. *Pedes* breves. Femoribus ovato-compressis, tibiis tarsisque gracillimis simplicibus, tibiis anticis ante apicem internè emarginatis.

Silphomorpha fallax.

Obscurè piceo-nigra, haud nitida, sublentè punctatissima; elytris striis decem punctorum parvorum notatis, ore, antennis, pedibus corporeque piceis.

Long. corp. lin. $7\frac{1}{2}$.

Habitat in Novâ Hollandiâ.

In Mus. Dom. Hope, Melly, Newman.

The four preceding genera possess, as will be readily seen, so many characters in common, that they would doubtless be considered as belonging to the same genus, were they not carefully examined. All of them possess the same formation of the legs, (namely, large oval compressed femora, with very slender tibiæ and tarsi,) mandibles, maxillæ, minute maxillary palpi, truncate labial palpi, &c. But I think the differences pointed out above will be considered amply sufficient to warrant the establishment of distinct genera for their reception.

As to their immediate conjoint affinities amongst Carabideous insects, it is exceedingly difficult to decide. Mr. Kirby considered *Pseudomorpha* as doubtfully allied to *Omophron* (Latr., *Scolytus*, F.), its sessile head bringing it near to that genus and the aquatic *Entomophagi*. It is probably on account of this

supposition that he observes, "Habitat in Georgiæ forsan aquaticis?" He however noticed several circumstances which seemed to indicate an approximation towards *Lebia*, *Dromius*, *Tarus*, &c.; and Dejean, without being aware at the time of the observations of Mr. Kirby, placed it in the subfamily *Truncatipennes* (*Brachinidæ*, MacL.), with some of the genera of which group, such as *Coptodera*, *Orthogonius*, *Thyreopterus*, &c. these insects seem to me to be most nearly allied.

It is certainly a curious fact in the geographical distribution of Insects, that so aberrant a form as is indicated by the four insects noticed above should be found in regions so distant as North America, Brazil, and New South Wales. This fact alone I should imagine must be considered sufficient to prove that a wide geographical range is not the character of a typical group, as stated by Mr. Swainson.

The two insects represented in the accompanying figures 5 and 6, are *Rhyzopertha*, (Steph.) *pusilla* (Fabr.), and *Tomicus* (Latr.) *fuscus* (Marsh.), which in their xylophagous habits, cylindrical form, pitchy-ferruginous colour, punctated surface, transversely rugose thorax extending over the concealed head, dentate tibiæ, and short antennæ, are so very nearly alike, that by many authors they have been even placed in the same genus. A minute investigation of their structure proves them however to be totally different in their essential organs, the antennæ, trophi and tarsi. In these respects *Tomicus* will be found to belong to the group having the elm-destroying *Scolytus* as its type; whilst *Rhyzopertha* is most nearly allied to the genus *Bostrichus* of Geoffroy (*Dermestes capucinus*, Linn.). These two groups have indeed by many persons been considered to belong to the same family *Bostrichidæ*; and even by those who have ventured to place them in different groups, they have been made to follow each other without any intervening link; being indeed employed when thus connected to form the transition between the Pentamerous *Ptinidæ* and the Pseudotetramerous *Curculionidæ*, to which last *Scolytus* most intimately approaches.

That the relation between these two groups, notwithstanding the many points of connexion, in habit, economy, and even structure, is not an affinity, but merely an analogy, I entertain very little doubt, but our comparative ignorance of the structure and larvæ of the Xylophagous insects of Latreille

prevents a positive assertion upon this point*. The variations, however, existing between these two groups in the important organs noticed above is so great, that, in comparison with the structure of other allied tribes, it must be admitted that we here find the real characteristics of an analogy, namely, external similarity of form, but a complete diversity of structure in the essential organs.

The examples hitherto produced have exhibited analogies existing between insects belonging to the same order. In this latter respect, however, (or, in other words, on account of their Coleopterous structure,) they are related together by affinity.

Of the still more widely extended relationship resulting from analogy, many examples might be given. Some have already been noticed in the introductory remarks upon the genus *Diopsis*, published in the last volume of the Transactions of this Society. Others may be mentioned wherein a great enlargement either of the scutellum or the posterior part of the prothorax is observed, which, contrary to the ordinary structure, is extended entirely over the body and wings. The genus *Scutellera* (so named from this circumstance) amongst the Heteropterous *Hemiptera*, many *Centroti*, &c. amongst the Homopterous *Hemiptera*, the species of *Acrydium* (*Tetrix*, Latr.) in the order *Orthoptera*, *Thorocantha*, Latr., in the *Hymenoptera*, and *Celyphus*, Dalm. in the *Diptera*, —respectively exhibit this singularity of formation.

The curious genus *Copium*, Thunberg (*Holhymenia*, Serv. and St. Farg.), is strikingly represented amongst Dipterous insects by the insect which I have figured in Griffiths's "Animal Kingdom" under the name of *Diateina Holhymenioides*, and in which the structure of the antennæ, and even the white colour of the terminal joints, are especially traceable in a most singular manner.

The Neuropterous genus *Ascalaphus* in like manner analogically represents the genus *Papilio* in another Order, *Lepidoptera*. But the most complete instance which I have hitherto met with, of deception produced by an insect of one order assuming the appearance of another, occurs in the species about

* P.S. The recent discovery by Dr. Ratzeburg of the larva of *Bostrichus capucinus* fully confirms my supposition, it being hexapod, whilst that of the *Scolytidæ* is apod. Thus whilst the antennæ, trophi, tarsi and larvæ of *Rhyzopertha* and *Tomicus* are totally distinct, their general form and habits are similar, thus establishing their relation as one merely of analogy.

to be described, and which for a great length of time I had arranged in my cabinet amongst the *Cicindelidæ*, regarding it as an immature *Colliuris* or *Tricondyla*, although it in reality belongs to the order *Orthoptera*.

Fam. GRYLLIDÆ. *Leach.*

(*Locustariæ*, Latr. *Locustina*, MacL. *Gryllus Tettigoniæ*, Linn.)

Genus. Condylodera.

(*Obs.* Insecti, typum hujus generis constituentis, individuum unicum solùm vidi, cum alis et tegminibus brevissimis, abdominis basin tantùm tegentibus. An in statu pupæ sit, aut, ut potiùs mihi videtur, imaginis speciei alis incompletis gaudentis, ut in *Ephippigeris*?)

Corpus elongatum, thorace anticè attenuato, nodoso, oculis valdè prominentibus.

Caput thorace paullò latius, lateribus pone oculos, rotundatis; vertice convexo, tuberculo parvo conico inter antennarum basin; facie verticali. *Oculi* magni, rotundati, valdè prominuli. *Antennæ* graciles, inter partem inferiorem oculorum insertæ, articulis duobus basalibus crassioribus (articulis terminalibus in specimine viso mutilatis.). *Labrum* in medio articulatum, parte anticâ transversâ margine antico in medio paullò producto, ciliato. *Mandibulæ* validæ, breves, apice denticulatæ. *Maxillæ* elongatæ, lobo interno gracili curvato, apice tridentato, lobo externo galeato, biarticulato, articulo basali brevi; *palpi maxillares* maxillâ paullò longiores, filiformes, 5-articulati, articulis 4 basalibus subæqualibus, extimo paullò longiori et crassiori, apice truncato. *Mentum* oblongum, planum. *Labium* quadrilobatum, lobis duobus internis brevibus acuminatis, binis externis majoribus ad apicem conniventibus. *Palpi labiales* filiformes, breves, 3-articulati, articulo 1mo brevissimo, 2ndo paullò longiori extimo oblongo-ovato, apice truncato.

Prothorax elongatus, subcylindricus, bistrangulatus, nodum medium rotundatum efformans, nodoque postico majori lateribus rectè deflexis et obliquè truncatis. *Meso-* et *metathorax* brevissimi. *Segmenta thoracica* subtùs inermia (*sternis* muticis.).

Tegmina et *alæ* coriacea, abbreviata, rudimentalia, ovato-triangularia nervis longitudinalibus. *Pedes* elongati, gracillimi, *tibiis anticis* basin versus

ocello subfenestrato instructis, femoribus omnibus subtùs paullò denticulatis, posticis duobus basi incrassatis; *tibiis posticis* serie duplici denticulorum parvorum; *tarsis* 4-articulatis, articulo 3tio bilobato.

Abdomen maris prothorace brevius, subcylindricum, apicem versus attenuatum, articulo penultimo appendiculis duobus abbreviatis obtusis et setosis instructo.

Fœmina haud detecta.

Obs. Hoc genus affinitatem intimam exhibet cum *Ephippigerâ* thoracis structurâ, tegminibus alisque abbreviatis.

Spec. 1. Condylodera Tricondyloides.

Cærulea; prothorace subpurpureo capiteque punctatis, abdomine nitido lævi, antennis albidis fusco-annulatis, articulis duobus basalibus nigris, palpis fulvis, articulo extimo fusco, femoribus fulvo-rufis, posticorum basi maculâ cyaneâ, tibiis fuscis albido-lineatis, spinulis albidis, tarsis fuscis, articulis duobus basalibus suprà albidis, stylis analibus fulvis.

Long. corp. lin. 9.

Habitat in Javâ.

In Mus. nostr.

I have applied the specific name of *Tricondyloides* to designate this insect, which not only in its general form and nodose thorax, but also in its peculiar colours (by which alone it is distinguished from nearly every other Orthopterous insect), so singularly represents the Cicindelideous genus *Tricondyla*. Another curious circumstance attendant upon this analogy is, that the locality of both these groups is the same, namely, Java.

EXPLANATION OF TAB. XXVIII.

Fig. 1. *Pseudomorpha excrucians*, K., and details.

1 *a*. Underside of the head. * An elevated line indicating the ordinary place of articulation of the mentum.

1 *b*. Maxilla.

1 *c*. Extremity of anterior tibia.

Fig. 2. *Adelotopus Ipsoides,* Westw. 2 *a.* Upper side of the head. *i.* and *i.* representing the genæ visible from beneath. 2 *b.* Underside of the head. *a.* The situation of the articulation of the mentum. *e.* Mentum. *d.* Jugulum. *f.* Maxillary palpus, the base of the maxilla concealed by the side of the mentum. *i.* The immensely developed genæ. *c.* The canal for the antennæ, *g.*

Fig. 3. *Sphallomorpha decipiens,* Westw., and details.

3 *a.* Front of head above, with the mandibles and labrum.

3 *b.* Underside of the head. *a.* A very indistinct line, terminating on each side in a slight notch and bristle, and indicating the ordinary place of the articulation of the mentum. *b.* A deep canal for the action of the base of the maxilla *f.*, and separated from the outer canal *c.* (formed for the reception of the antennæ *g.*) by an elevated ridge *i.* *d.* Jugulum. *e.* Mentum.

3 *c.* Maxilla. 3 *d.* Labial palpus. 3 *e.* Underside of anterior tarsus.

Fig. 4. *Silphomorpha fallax,* Westw., and details.

4 *a.* Front of head, above, with the mandibles and labrum.

4 *b.* Underside of the head, exhibiting no traces of the ordinary articulation of the mentum, which here forms a component part of the skull.

4 *c.* Maxilla.

4 *d.* Underside of the thoracic segments, showing the acuminated prosternum (*) and the small size of the metasternum (**).

Fig. 5. *Rhyzopertha pusilla,* Steph., and details.

5 *a.* Labrum. 5 *b.* Mandible. 5 *c.* Maxilla. 5 *d.* Instrumenta labialia. 5 *e.* Antenna. 5 *f.* Fore tibia and tarsus.

Fig. 6. *Tomicus fuscus,* Marsh., and details.

6 *a.* Mandible. 6 *b.* Maxilla. 6 *c.* Mentum and labial palpi. 6 *d.* Antenna. 6 *e.* Fore tibia and tarsus.

Fig. 7. *Condylodera Tricondyloides,* Westw., and details.

7 *a.* Front of head. 7 *b.* Mandible. 7 *c.* Maxilla. 7 *d.* Instrumenta labialia.

XXIV. *A Note upon the Anatomy of the Roots of* Ophrydeæ. *By* John Lindley, *Ph.D. F.R.S. & L.S., Professor of Botany in University College.*

Read February 5th, 1839.

It is well known, that the substance imported from the Levant under the name of *Salep*, consists of the parboiled tubercles of certain *Ophrydeous* plants, probably belonging to the genus *Orchis* itself; but while writers are agreed as to the source of Salep, there is so much difference among them, as to the nature of the principle it contains, that it has appeared to me desirable to ascertain whether anatomical examination would not decide the question better than the ordinary methods of chemical investigation; and the result has justified my expectation.

The following instances of difference in the statements of writers upon Salep will serve to show how far we yet are from understanding the nature of this very common substance.

Berzelius says it contains very little gum and starch, but much vegetable mucus (Pflanzenschleim). Caventou describes it as containing a substance like Bassorine; that is, a gummy principle differing from gum in being insoluble, only swelling up into a jelly, and from all varieties of starch by not forming a blue compound with iodine.

On the other hand, Guillemin says it is composed "presqu' entièrement de matière féculante" (*Dict. Class.* xv. 70.), a statement which I quote merely to show the prevalent opinion of French writers on such subjects; an opinion which is by no means changed. Guibourt, who, in order to form a correct idea of Salep, examined Orchis roots before they were prepared, declares that they are composed "d'une grande quantité d'amidon" in grains the size of wheat starch; and he adds, that this starch is entirely filled by a pulpy matter, insoluble in cold water, but swelling and dividing very much in hot

water. He also finds the Salep of the shops consisting, with the exception of a few grains of unchanged starch, in great part of swelled, torn, gelatinous skins, which become of a magnificent blue when moistened with the aqueous solution of iodine. (*Histoire des Drogues Simples*, i. 573.)

Raspail speaks of the new tubercles of Orchis as being rich in fæcula, and he supposes that those chemists who have not been able to find it, examined old shrivelled roots whose starch had been consumed by the plant in its growth, instead of newly-formed roots. (*Syst. de Chim. Organique*, p. 54.)

Finally, M. Payen, in his recent memoir upon Amidon, of which the first part, without the plates, is all that I have yet seen (*Ann. des Sc.*, n. s., x. 26.), describes Salep as containing grains of fæcula, formed into amorphous masses which fill the cells. "Ce caractère," he adds, "dépend sans doute de la temperature élevée à laquelle la désiccation a commencé; les tubercles étant alors très humides la fécule a dû former empois en s'hydratant dans chaque cellule; de la encore la demitransparence de la plupart des petits tubercules secs."

The following account of the anatomy of the roots of Ophrydeous plants will show that, notwithstanding the assertions of so many French writers upon Salep, these tubercles contain very little starch, and that these authors have mistaken for amylaceous matter what Berzelius terms vegetable mucus, and Caventou and Meisner a principle resembling Bassorine, the organic characters of which, in these plants, are extremely curious.

The tubercles which form the roots of many South African *Ophrydeæ* present, when dried, the appearance of bags filled with small pebbles; the surface of the roots being coarsely granular, as if the epidermis had contracted over hard bodies in the inside. This is very remarkable in the dried fusiform roots of *Disa multifida*.

If a fresh root of *Satyrium pallidum* is divided transversely, the cause of this appearance becomes evident. With its soft parenchyma are mixed a great quantity of tough, firm, oval nodules, clear as water, and often twenty times as large as the cells which surround them. These nodules are easily separated from the tissue in which they are imbedded, when they are found to be irregular polyedrons, resembling pebbles of cut rock crystal. Their fa-

cettes are produced by the pressure upon them of the cells of parenchyma among which they lie. They are tough like horn, cannot be torn, crackle between the teeth like fragments of caoutchouc, and may be easily cut or even sliced, when they seem to be perfectly homogeneous, exhibiting no trace of layers or successive deposits, either when fresh, or after being dried, or when acted upon by ordinary chemical reagents. These nodules are mostly of about the same size, but here and there some are to be seen not larger than the ordinary cells of parenchyma. The latter is thin-sided, in no degree pitted, and is readily coloured brown by the alcoholic solution of iodine or by exposure to air. Each cell bears with considerable regularity a cytoblast upon some part of its walls, and in most of the larger cells there is a small quantity of starch, readily coloured blue by the aqueous solution of iodine. Otherwise the parenchyma contains no solid matter, with the exception of occasional parcels of acicular raphides.

The nodules are scarcely soluble in cold water, but when boiled they become tumid and partially dissolve into a transparent jelly, with a vitreous lustre. If exposed to the air they rapidly dry and become deep brown. The aqueous solution of iodine produces no sensible effect upon them in their natural state; but if they are first treated with caustic potash, or nitric or sulphuric acids, all which dissolve their contents, they then acquire a deep claret colour when acted upon by alcoholic solution of iodine.

But although iodine, in the form of the aqueous solution, while it colours blue the grains of starch, produces no sensible effect upon the nodules themselves, yet it does produce an effect if the alcoholic solution is employed. In that case the nodules slowly become amethystine, altering to claret colour; and if the nodules are wounded, the latter colour gradually, but slowly, extends over the wound. These colours, however, soon disappear, especially if the air is warm; not a trace of blue is at any time observable. The nodules are therefore not starch. Indeed I believe there is no known instance in which this common substance possesses even the organic characters which have been just described; nor am I aware of any other case of the solid secretions of plants assuming such an appearance as is found in the subject of these remarks. The cysts containing oily matter in the rind of the Orange are, in some respects, most analogous.

The roots of all the other *Ophrydeæ*, whether European or not, which I have had the opportunity of examining, are constructed essentially in the same manner as that of *Satyrium pallidum*. The differences I find among them consist chiefly in the size and shape of the nodules, and in the proportion they bear to the surrounding parenchyma; in the quantity of starch formed in the latter; and in the way in which sections of the tubercles are affected by exposure to the air. In *Orchis maculata*, for instance, there is more starch than usual, the nodules when fresh are not much larger than the cells of surrounding parenchyma, and the section of the root remains white, while in *Satyrium pallidum* it becomes deep brown. Beyond this I have observed nothing which deserves notice.

But while the presence of nodules is so universal in this tribe of *Orchidaceæ*, it is not a little singular that they should be as generally absent in the tubercles of the other tribes of the same natural order. Up to the present time I have not succeeded in detecting them in any species of *Neottieæ* or *Arethuseæ*, of which I possess roots. In the tubercles of New Holland *Orchidaceæ* the cells appear to be exclusively occupied by starch, with which they are in fact filled; at least, such is the case in *Glossodia minor*, *Thelymitra carnea*, and another species, *Caladenia testacea*, *Corysanthes bicalcarata*, and many species of *Diuris* and *Pterostylis*.

I have already stated that the nodules appear to be homogeneous. But the slowness with which their horny contents are acted upon by the alcoholic solution of iodine, and the frequent arrangement of the secretions of plants in a stratified manner in the lignified parts of vegetation, led me to suspect that this homogeneity was only apparent. Nevertheless, for a long time I sought in vain for evidence of their contents being organized; in whatever way they were cut, whatever reagents were employed, sections of the nodules presented the same unvarying uniform surface. At last, upon examining some *Covent Garden Salep*,—a coarse preparation of wild *Ophrydeæ*,—thin slices of which I had made with a knife whose edge had lost its keenness, and which therefore bruised the Salep while cutting it, an indistinct granular appearance became visible upon some of the divided nodules, not however so well defined as to enable me to judge of its real nature. But upon charring the slices by Mr. Reades' process, a beautiful definition of the granulation was obtained.

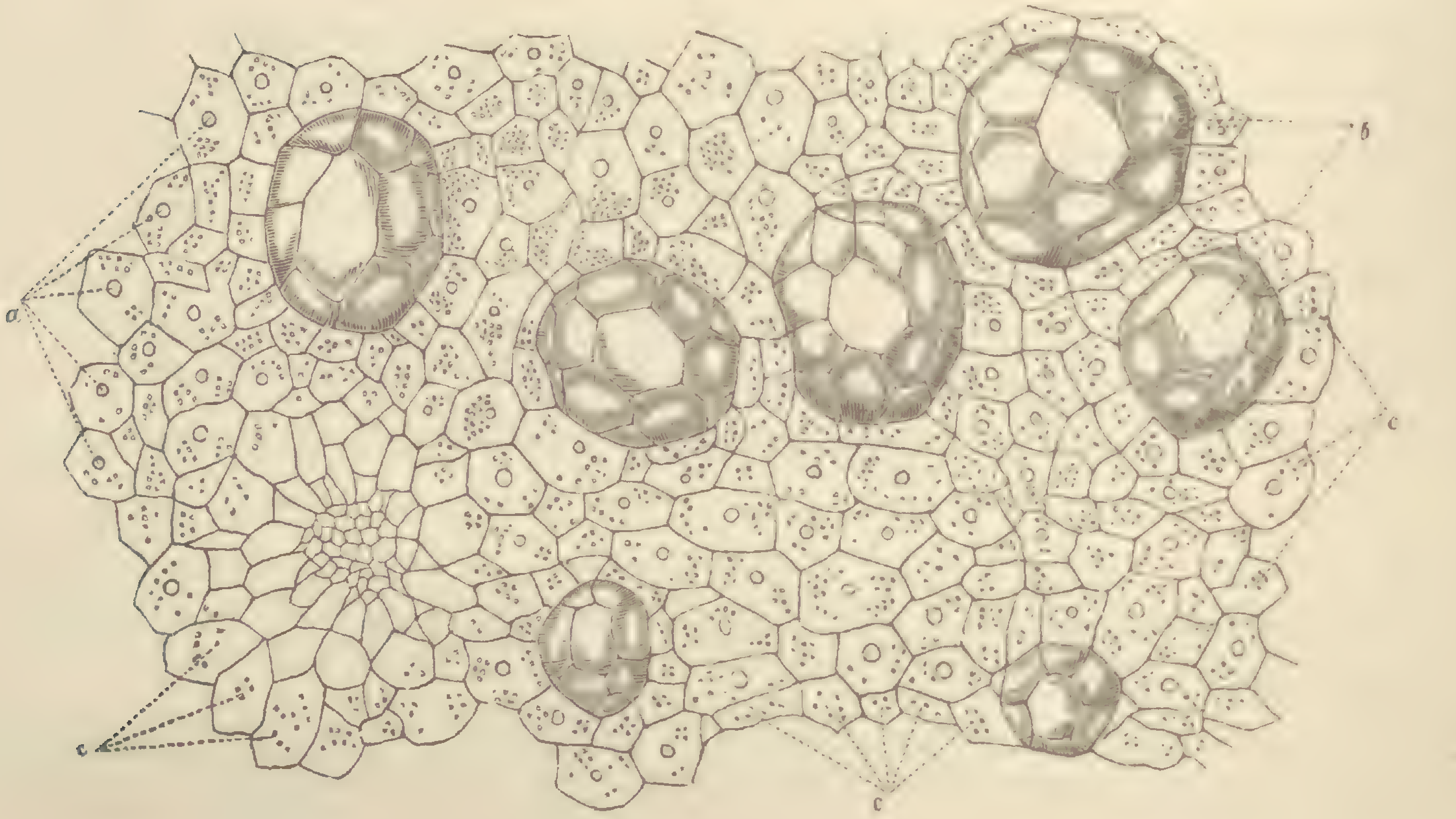
It then appeared that the nodules, apparently so homogeneous, are composed of extremely minute transparent cells, filled, I presume, with a secretion of the same refractive power as themselves, and adhering to each other so firmly, that in their fresh state no spaces could be detected among them. In their charred condition, however, the double walls of the cells, intercellular spaces, and even here and there the cytoblasts, became so distinctly visible, that the accompanying figure 3. was readily made with a camera lucida adapted to an achromatic microscope magnifying 480 diameters.

These statements are, I should think, sufficient to show that the roots of *Ophrydeæ* are not composed, to any great extent, of starch, but that their peculiar properties are owing to the presence of a large quantity of a gummy secretion, which for the present may be called Bassorine, collected in cellular horny nodules.

It remains for me to explain in what way the error has probably arisen of those who, like Guibourt and Payen, describe Salep as chiefly composed of starch. It is well known that Salep is prepared by boiling the roots of *Ophrydeæ*, and then drying them. The effect of boiling is to dissolve what starch exists in the parenchyma surrounding the nodules of Bassorine; the dissolved starch will flow over the sides of the cells and the surface of the nodules, from which when dried it becomes undistinguishable; and consequently when iodine is applied to Salep, the whole mass will appear to have become iodide of starch. Attention having been called to the facts above mentioned, there remains no difficulty in seeing that the general diffusion of blue is apparent only. In reality, if, after iodine is applied to Salep and the blue colour is produced, the nodules are removed, which is not difficult, they are found to retain their original vitreous lustre, and to have been coloured apparently only by the reflection, through their semitransparent sides, of the blue iodide of starch by which they are surrounded. That this explanation is true, may be proved experimentally, by examining the roots of *Orchis maculata*, both fresh and subsequently to their being made into Salep.

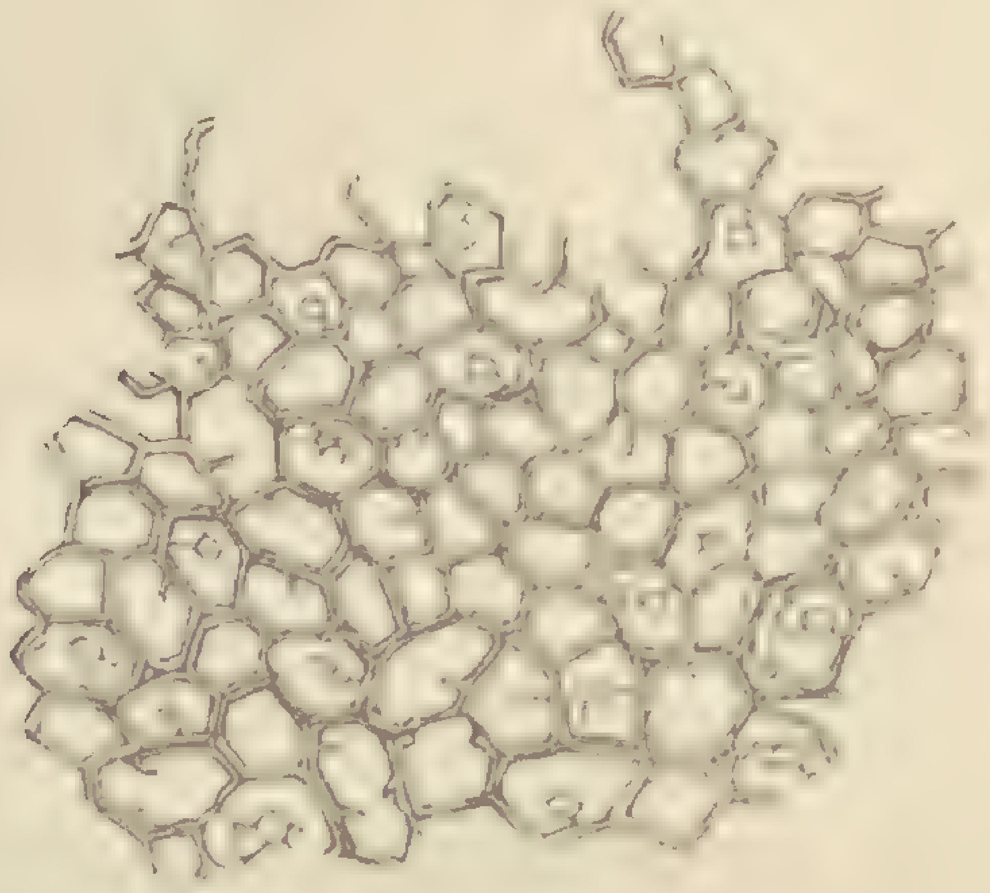
February 2, 1839.

1.



2.

3.



EXPLANATION OF THE FIGURES.

Fig. 1. A section, highly magnified, of a fragment of the root of *Satyrium pallidum*. *a. a. a.* Cytoblasts. *b. b.* Nodules of Bassorine. *c. c. c.* Granules of starch.

2. A cell, which once contained Bassorine, emptied of its contents by caustic potash, and pressed flat. The circumference is irregularly cracked by the pressure that has been employed.

3. A view of the cellular structure of the nodules, seen after being charred, and examined with a microscope magnifying 480 diameters.

All these figures were drawn with a camera lucida.

XXV. *On the* Heliamphora nutans, *a new Pitcher-plant from British Guiana.*

By George Bentham, *Esq., F.L.S.*

Read February 4, 1840.

Amongst a number of new and handsome plants collected by Mr. Schomburgk on the mountain of Roraima, on the borders of British Guiana, one of the most curious is a species of Pitcher-plant, which he found growing in a marshy savannah, at an elevation of about six thousand feet above the level of the sea. As this plant is a new form in a very distinct natural Order, the *Sarraceniaceæ*, hitherto consisting of but one genus, and only six species, I have thought that the following short account of it might not be uninteresting to the Linnean Society.

Like the true *Sarraceniæ*, this is an herbaceous plant, with fibrous roots and radical leaves, of which the petiole forms a long hollow tube or pitcher, open at the top, and the lamina a small concave lid, which does not, however, as in *Nepenthes*, close over the pitcher. The parallel veins of the pitcher, with transverse reticulations, and the thick texture and reticulate venation of the lid, are the same in *Heliamphora* as in *Sarracenia*.

A curious disparity in the texture of the reflexed hairs of the inner surface of the pitcher has been pointed out to me by Dr. Lindley, and I observe precisely the same structure in *Sarracenia purpurea*. The hairs which densely close the mouth of the pitcher are thick, conical, and striated, without any of the ordinary appearances of secreting hairs, although this part of the leaf is said, in *Sarracenia* at least, to be generally covered with a saccharine exudation. At the bottom of the pitcher, and below the smooth shining part (the same in *Heliamphora* as in *Sarracenia*), the scattered hairs, smaller than those of the throat, but still reflexed, have all the appearance of ordinary secreting hairs. They arise from a small tubercle, and appear to be composed of a single

cell, forming a hollow tube, in which in the dried state there appears to be more or less of congealed matter, probably fluid when fresh. These secreting hairs are somewhat conical in *Heliamphora*, very long and slender, but with the same structure in *Sarracenia purpurea*.

Notwithstanding several memoirs which have been already published on the *Sarraceniæ*, it does not appear that any course of observation and experiment on the living plant has ever been closely and carefully followed up with a view to ascertaining the precise nature and functions of the abovementioned very distinct portions of these singular pitchers. They are constantly observed with more or less of an aqueous fluid in them, which is generally supposed to be chiefly, if not entirely, water derived from rains and dews, a circumstance not at all borne out by the structure as it appears in the dried state. The lower portion is evidently contrived to produce copious secretions; the central apparently smooth portion, often covered with an infinity of minute glands, appears destined to some important function in the economy of the leaf, and the form of the opening appears but ill contrived for the mere purpose of collecting rains and dews. One effect of the singular clothing of the orifice is known to be the retaining such insects as may venture within it, and some have even gone so far as, on that account, to consider these plants as carnivorous; but surely, if killing the insects were the main object of this apparatus, it would meet with better success than the imprisoning some half a dozen flies or beetles during the whole season the leaf lasts. It were therefore much to be wished, that American botanists, who have opportunities of observing these plants under those circumstances which are natural to them, would carefully ascertain the state of the different parts of the pitcher, the nature and amount of any secretions, and any other phenomena that may take place at different times of the day and of the season, at various ages of the plant, and under various states of the atmosphere, which alone can enable us to found any conjectures on its physiological functions.

The scape of *Heliamphora*, instead of being one-flowered, as in *Sarracenia*, bears a loose raceme of from two to six nodding flowers, borne on short pedicels, each pedicel springing from the axilla of a concave bract, similar in venation to the pitcher part of the leaves. There is no trace of any bracteolæ on the pedicel.

The floral organs differ chiefly from those of *Sarracenia* in the great reduction in the number of parts. Instead of three distinct series of floral envelopes (three external bracts, five sepals and five petals), *Heliamphora* has but four, five, or (as observed by Mr. Schomburgk) six leaflets altogether, of which the external are somewhat thicker and more herbaceous than the more internal ones, though all are to a certain degree petaloid and coloured. Where there are four or five, the æstivation and position is the same as those of the sepals of *Sarracenia*, but they are more imbricate, each leaflet overlapping more or less the next opposite one on one side, even at their insertion. I have not seen any flowers with more than five leaflets, and I therefore do not know the position of the sixth.

The stamens are indefinite, and placed as in *Sarracenia*; there were twenty-one in the flower-bud I opened: from twenty-seven to thirty-two in most flowers, according to Mr. Schomburgk. The anthers are versatile, turned inwards in the bud, and the cells open longitudinally.

The ovary differs from *Sarracenia* in being three-celled only, instead of five-celled; in other respects, the number, arrangement, and structure of the ovules agree perfectly with *Sarracenia*. The style is erect and cylindrical, but is truncate, and minutely ciliated at the apex, with an obscurely three-lobed stigmatic surface, without any tendency to the remarkable foliaceous expansion of the stigma of *Sarracenia*.

I have not seen the capsule of *Heliamphora*, but Mr. Schomburgk describes it as "three-celled, three-valved, with numerous seeds." A few ripe seeds communicated to me by him are rather larger than in *Sarracenia flava* and *psittacina*, the only two species of which I have the fruit*: the testa is brown, less tuberculated than in *Sarracenia*, but expanded into a membranous wing surrounding the seed. The albumen and embryo are the same in both genera.

From this sketch it will be seen that all the essentials of arrangement and insertion of the floral organs, and of the conformation of the ovary and seed, are as in *Sarracenia*, and place this new plant in the same Order: the differences in the number of parts cannot here have any other than a generic im-

* The seeds of *Sarracenia* are described as "minute," a vague term, scarcely applicable in this case as in both the above-quoted species they are full one line long, and obovoid.

portance, as it is evident from their variableness and want of symmetry that they are reductions from a normal type.

As to the general affinities of the Order, this genus, a less complete one than *Sarracenia* itself, does not appear to furnish any further elucidations, excepting in as far as it proves that neither the symmetry of the floral envelopes, nor the foliaceous stigma of *Sarracenia*, are of importance. The inflorescence, the only character more developed in *Heliamphora*, is not different from that of *Papaveraceæ*, to which order, as well as to *Nymphæaceæ*, some affinities have been already indicated by various botanists, from both of which Orders, however, the placentation essentially removes the *Sarraceniaceæ*.

I now proceed to give the technical character of the *Heliamphora nutans*, of which I have derived the generic name from ἕλος, a marsh, and ἀμφορεὺς, a pitcher.

HELIAMPHORA.

Ordo Sarraceniacearum.

Char. Gen. Perigonii foliola 4, 5, (vel. 6?) hypogyna, libera, æstivatione valdè imbricata, subpetaloidea. *Stamina* numero indefinita, hypogyna. *Antheræ* oblongo-lineares, versatiles, biloculares, loculis appositis longitudinalitèr dehiscentibus. *Ovarium* triloculare, ovulis numerosis anatropis pluriserialitèr placentæ axili affixis. *Stylus* simplex, apice truncatus. *Stigma* parvum, obscurè trilobum, minutè ciliatum. "*Capsula* trilocularis, trivalvis, polysperma." (Schomb.) *Semina* obovata, compressa, testa fusca laxiuscula, vix rugosa, in alam fusco-membranaceam semen cingentem expansa. *Embryo* parvus, teres, rectus prope basin albuminis copiosi, radicula juxta hilum, cotyledonibus parvis.

Sp. *H. nutans. Herba* perennis, uliginosa. *Folia* radicalia; petiolus tubuloso-amphoræformis, basi attenuatus, dein inflatus, sub ore parùm contractus, ore obliquè margine subrevoluto, parallelè plurinervis et transversìm reticulato-venosus, extùs glaber et latere interno alis duabus angustis longitudinalitèr auctus, intùs apice densissimè pilis reflexis striatis nitentibus vestitus, medio glaberrimus, basi pilis simplicibus excretoriis reflexis sparsis asperrimus. *Lamina* parva, orbiculata, concavo-cucullata, crassiuscula, reticulata, glabra. *Scapus* erectus, (1—2-pedalis,) apice simplicitèr

racemosus, glaber. *Pedicelli* alterni, glabri, solitarii ad axillam bracteæ ovatæ complicatæ acuminatæ paralleli-venosæ glabræ. Prope basin scapi folium nonnunquàm adest forma inter illas foliorum radicalium et bractearum ferè media, nempè basi bracteis simile supra medium marginibus connatis subamphoræ-forme. *Flores* nutantes, albi, v. pallidè rosei. *Perigonii* foliola expansa, ovato-lanceolata, acuminata, glabra, 15-16 lin. longa. *Stamina* glabra, filamentis basi crassioribus. *Ovarium* ovoideum, pubescens. *Stylus* glaber.

EXPLANATION OF TAB. XXIX.

Heliamphora nutans.

Fig. 1. The flower, with the perigon removed, showing the stamens.
2. A single stamen, front view.
3. The same, back view.
4. Style and ovary.
5. Transverse section of the ovary.
6. Diagram of the arrangement of the floral parts.
7. Seed.
8. The same, with the testa removed.
9. Longitudinal section of the same.
10. Portion of a young petiole, showing the inner surface of the natural size. *a.* Hairs of the orifice, highly magnified. *b.* Hairs of the bottom of the pitcher, magnified to the same degree.

Nos. 1. to 9. are all more or less magnified.

XXVI. *Descriptions of some new Insects, collected in Assam by* William Griffith, *Esq., Assistant-Surgeon in the Madras Medical Service, and attached to the late Scientific Mission to Assam. By the Rev.* Frederick William Hope, *M.A., F.R.S., & L.S.*

Read November 5, 1839, and April 21, 1840.

Insects from the Burmese territories, or from Assam, are equally rare; a few species some years since were brought to England by the late General Hardwicke, from the latter country, and they are now deposited along with his valuable collection of Oriental zoology in the British Museum. A *second* collection from the same locality, consisting of two glazed cases, were presented to me by Lady Jones. The nondescripts of a *third* also were kindly given me by Dr. Cantor, the celebrated herpetologist. The only insects from the same regions of my acquaintance which I have not mentioned, (with the exception of Mr. Solly's,) are some magnificent species figured in the Transactions of the Entomological Society of London; they were transmitted from the East Indies to Mr. Rucker: all of them are described as inhabiting the East; no specific locality, however, happens to be stated. Recognising every species in Mr. Solly's collection (with one exception only), and some of them in considerable numbers, I do not hesitate to give an opinion, that they were also collected in the territories of Assam. The insects which I now proceed to describe for the Linnean Society are entirely new to European entomologists; some of them are remarkable for magnitude, splendour, and colouring, and I regard them as equal, if not superior, to any of the choicest specimens of our metropolitan cabinets. By permission of Mr. Solly, I described a portion of the rarities for the Entomological Society of London; the more splendid I have reserved for the Linnean, and which I now submit to the notice of its members.

The major part of the selected species belong to the Longicorn Beetles, and as I do not accord with the arrangement of Monsieur Audinet Serville (published in the French Entomological Transactions), particularly in the grouping of the *Lamiadæ* of Leach, it may be adviseable to commence with some short observations on the *Lamiadæ*.

The typical species of *Lamia*, according to Fabricius, was *Lamia Gigas*; that species is now detached from *Lamia* by Serville, under the generic name of *Omacantha*. The type of true *Lamia*, according to the above author, at present appears to be either *Lamia Rubus*, Fab., or some other closely allied species. He has, however, included under the same head three other species, differing considerably in form, and which may be regarded as subgenera belonging to another family. The natural sections of *Lamia* appear to be three; first, those which have the sutural apex of the elytra acuminated, each wing being internally more or less spiny, whilst the lateral angles are invariably rounded; secondly, those which have the sutural apex spiny, as well as the lateral angles spinose; and thirdly, those which have the elytra rounded at the apex, and without any spines medial or lateral. The last section requires still further subdivision, and most willingly do I leave that task for others. It is time, however, to proceed to the description of the species. I commence with true *Lamia*.

Lamiadæ, *Leach.*

Lamia Horsfieldii.

Long. lin. 26. Lat. lin. 8½.

Corpus cinereum; antennis corpore longioribus elytrisque flavo-cretaceis maculisque ornatis. *Antennæ* articulis tribus primis subscabris. *Thorax* utrinquè spinâ validâ acutâ armatus. *Elytra* nebulosa, basi rugosa, apice unidentata, maculis flavo-cretaceis aspersa. *Pedes* corpore concolores. *Corpus* infrà cinereo-nebulosum, marginibus capitis et corporis albidis.

This magnificent species I have named in honour of Dr. Horsfield, the author of a valuable work on the metamorphosis of Indian *Lepidoptera*. With regard to size, the species ranks amongst the largest of the *Lamiadæ* which have yet been described as belonging to the East. *Lamia catenata* of De Haan, from Japan, is a species closely allied to it. It differs, however, in

various particulars. I have not figured it, as true *Lamia* is well known to entomologists.

Euoplia*.

Corpus subdepressum. *Antennæ* lamiæformes ferè ut in *Omacanthâ*. *Thorax* utrinquè spinosus, dorso punctulatus. *Elytra* depressa, apicibus 2-spinosis, spinâ suturali minore, lateralibus majoribus. In reliquis cum *Lamiâ* convenit.

The above genus I propose to separate from *Lamia*, as it appears to afford ample characters to distinguish it. The antennæ in *Omacantha* differ in the different sexes, the terminal joint of the males being considerably larger than all the rest. In true *Lamia* the last joint is nearly equal in length in both sexes: *Euoplia* therefore is more allied to *Lamia Omacantha*, which one might expect, from a similarity in the general appearance of the insects; the former may be considered as the representative of *Lamia* in Africa.

Euoplia Polyspila.

Tab. XXX. fig. 6.

Long. lin. 16. Lat. lin. 5½.

Cinerea; antennis corpore longioribus, elytris depressis 2-spinosis variisque cretaceis maculis aspersis. *Corpus* infrà cinereum, pedibus concoloribus.

This species inhabits Assam; it is unique in the collection of Mr. R. H. Solly.

To the same genus belong the following undescribed species in my cabinet, namely, *E. octospilota*, *sulphurea*, *Bengalensis*, *Sinensis*, and *confusa*, all of them occurring in the East Indies. I am doubtful if this genus occurs in Africa: although it has been recognised in Africa, the entomology of the latter country seems to combine the character, and possess some of the leading characteristics, of both continents, and yet is remarkable for its peculiar types of form; one peculiar instance of which is the anomalous genus *Herodon*.

* From the Greek *εὐοπλία*.

Oplophora*.

Caput ferè quadratum. *Mandibulæ* falciformes. *Antennæ* paullò corpore longiores, articulis basi pallidis. *Thorax* utrinquè armatus, dorso fortitèr rugoso, tuberculo in medio disci posito. *Elytra* thorace quadruplò longiora, basi sinuata, subscabra, gradatìm è humeris ad apicem magnitudine decrescentia, apicibus rotundatis. *Corpus* infrà annulis abdominis ad apicem sensìm attenuatis. *Pectus* valdè convexum, mucrone armatum. *Pedes* difformes et robusti.

Habitat in Indiâ Orientali e regione Assamensi.

Oplophora Sollii.

Tab. XXX. fig. 4.

Long. lin. 24. Lat. lin. 8.

Viridi-aurata, splendida; thorace spinoso, elytris albo-punctatis. *Corpus* infrà nigrum, pectore femoribus aurato-viridibus, annulisque abdominis utrinquè cœruleo colore inquinatis. *Caput* anticè binis maculis oblongis cœruleis notatum. *Antennæ* nigræ, articulis basi pallidis. *Thorax* utrinquè valdè spinosus, dorso tuberculato, dente in medio disci conspicuo. *Elytra* metallico-viridia, anticè sinuata, subrugosa, variis maculis cretaceis sparsìm punctata. *Corpus* infrà nigrum, pectore cœruleo annulisque abdominis utrinquè. *Sternum* inter medios pedes mucrone armatum. *Pedes* difformes, nigri, cœruleoque colore variegati, plantis fusco-spongiosis.

This magnificent insect I dedicate to Richard Horsman Solly, Esq., a gentleman distinguished for his zeal in the promotion of science in general, and for his knowledge of vegetable structure and physiology, and one who has ever been a warm supporter of the Linnean Society.

The male of this species is only 19 lines in length, and 6 inches in width. It was presented to me by Lady Jones. Dr. Cantor informs me that he is aware of a second specimen. To the same genus belongs *Lamia punctator*, Fabr., and two unnamed species, which I have named after Sir Patrick Walker

* From ὁπλοφόρος, an armour-bearer.

and Colonel Sykes. *Lamia reticulator* of Fabricius, which is remarkable for its penicillated antennæ and truncate elytra, appears decidedly to belong to another genus not yet characterized.

Anoplophora *.

A new genus of *Lamiadæ* belonging to the third of my proposed sections. The following are its characters.

Caput quadratum. *Antennæ* corpore duplò longiores, ultimo articulo valdè elongato. *Thorax* utrinquè spinosus, medio depressus. *Elytra* anticè et posticè ferè æqualia, apicibus rotundatis. *Corpus* infrà squamosum, pectore inermi. *Pedes* difformes et robusti.

Anoplophora Stanleyana.

Tab. XXX. fig. 1.

Long. lin. 20. Lat. lin. 6½.

Nigro-viridis, nitida; antennis variegatis, thorace, elytris pedibusque cœruleo colore imbutis. *Caput* anticè maculis binis oblongis cœruleis notatum. *Antennæ* nigræ, articulis basi cœruleis, ultimo elongato atro. *Thorax* cœruleus, lineâ mediâ longitudinali nigrâ spinisque utrinquè concoloribus. *Elytra* nigro-ænea, nitida, maculis cœruleis aspersa. *Corpus* infrà concolor, segmentis abdominis posticè nigro-piceis, femoribus squamosis colore beryllino tinctis. Tibiis, tarsis, annulisque antennarum subcœruleis, plantis fusco-spongiosis.

This magnificent insect I have named in honour of the President of the Linnean Society. It is almost impossible to convey by description an idea of the beauty of this species. Its external appearance is of a light beryl colour: when examined under the lens, it has the appearance of mother-of-pearl, and closely resembles the feathery scales of the *Lepidoptera*.

The nature and causes of the colouring matter of insects is very imperfectly understood.

* From α, not, and ὁπλοφόρος, an armour-bearer.

Callichroma. *Latreille.*

Callichroma Cantori.

Tab. XXX. fig. 3.

Long. lin. 21. Lat. lin. 5.

Viride, nitidum; antennis violaceis, femoribus tibiisque lætè cyaneis tarsisque aureo ornatis. *Caput* anticè foveâ fortitèr impressâ. *Antennæ* mediocres, violaceæ, pubescentes, punctulatæ, articulo primo anticè spinoso. *Thorax* utrinquè spinosus, dorso tuberculato. *Elytra* læta, depressa, viridia, splendida, apicibus rotundatis. *Corpus* infrà cyaneum, segmentis abdominis sericie argenteâ obsitis. *Pedes* femoribus subscabris lætè cyaneis, tibiis concoloribus et compressis. *Tarsi* flavo-pubescentes, seu aureis capillis ornati.

The above insect inhabits Assam. The sexes of the species appear to differ in their antennæ, those of the males being more robust, and the elytra are more acuminated at the external angles. The true *Callichroma* of Latreille seems confined chiefly to the New World, although in modern catalogues we find some African species ranged under that generic title. Those species, however, with very conspicuous dilated tibiæ ought to be separated from *Callichroma*, as they evidently belong to a subgenus. M. De Haan mentions one Asiatic species in the Leyden collection. In my cabinet there is another elegant insect, which I have named *Ioscelis* from its violet-coloured legs: it is likewise from Assam. The present species is named in honour of Dr. Cantor. It is satisfactory to state, that his valuable collection of *Reptilia*, with his exquisite drawings, are safely deposited in the Radcliffe Library at Oxford,

Callichroma Griffithii.

Tab. XXX. fig. 2.

Long. lin. $20\frac{1}{2}$. Lat. lin. 5.

Obscurè atrum; antennis tarsisque luteis. *Elytris* nigris et flavo-fasciatis. *Caput* ferè quadratum, rufum, oculis nigris. *Antennæ* mediocres, pallidè flavæ, articulo primo anticè acutè spinoso. *Thorax* utrinquè obtusè armatus, tuberculatus, dorso ochraceo colore inquinato, margine omni ni-

gricanti, fasciis binis ochraceis notato, primâ ante medium disci positâ atque ad suturam vix extensâ, secundâ integrâ at latiori. *Corpus* infrà ochraceo-flavum, pubescentiâ subauratâ obsitum. *Pedes* femoribus fusco-flavis, tibiis tarsisque pallidioribus.

This insect also inhabits Assam, and is in the collection of Mr. Solly. It is named in honour of its discoverer Mr. Griffith, an acute and enterprising botanist, author of a valuable memoir on the Development of the Ovulum of *Santalum* and *Loranthus*, printed in the 18th volume of the Society's Transactions.

The clothing of this species I can only compare to an inferior velvet or a sort of plush; when rubbed it exhibits the appearance of bronze, and in places it resembles a rose-coloured copper. It is remarkable for a peculiarity of colouring, which I regard as of very rare occurrence. It appears as if the colouring matter of the second fascia had run, and had overwhelmed the black, the yellow-ochre taking its place.

Monochamus. *Megerle.*

Monochamus Ruber.

Tab. XXX. fig. 5.

Long. lin. 11. Lat. lin. 4½.

Ruber; antennis corpore duplò longioribus, thorace elytrisque nigro-maculatis, pedibus concoloribus. *Caput* anticè nigrum, posticè rubrum. *Antennæ* longissimæ, nigræ. *Thorax* disco rubro, spinis utrinque atris. *Elytra* rubra, humeris, scutello, maculisque variis nigris sparsim dispositis. *Corpus* infrà nigrum, pectore, segmentis abdominis utrinquè rubro-maculatis. *Pedes* atri, plantis fusco-spongiosis.

The above species, remarkable in its colouring, is also from Assam. I know of no species allied to it. The red colour, after the death of the insect, changes to a pale orange. I have seen some specimens so bleached by the light that casual observers would regard them as distinct species.

HEMIPTERA.

Nepadæ. *Leach.*

Cheirochela*.

Forma elongato-ovata. *Totum corpus* depressum.

Caput anticè rotundatum, posticè angustius, oculis rectis et ovalibus.

Antennæ minutæ, 4-articulatæ, articulis ferè æqualibus.

Thorax ferè trigonus, anticè valdè emarginatus, posticè dilatatus, rectè truncatus, utrinquè spinosus spinis acutis.

Scutellum magnum, trigonum, et æquilaterale.

Elytra anticè abdomini ferè æqualia, e medio disci sensim attenuata, posticè abdomine minora.

Corpus infrà depressum, segmentis abdominis externè spinosis.

Pedes compressi, *tibiis anterioribus* dilatatis, *mediis* posticè latioribus, *posticis* elongatis. *Tarsi* articulis ferè æqualibus, chelisque acutis.

Habitat in Indiâ Orientali.

Cheirochela Assamensis.

Long. lin. 10. Lat. lin. 6.

Fusca, ecaudata; thorace anticè valdè emarginato posticè spinoso, elytris posticè abdomine brevioribus rugosis, lineis binis elevatis obliquis insignitis. *Corpus* infrà flavescens, pedibus concoloribus. *Tibiæ anticæ* valdè dilatatæ et compressæ, *mediæ* ciliatæ, et ad apicem aureo-spongiosæ.

The peculiarities of this genus consist first in its very flattened form, and in the great size of the anterior femora. The anterior tibiæ and tarsi are confluent, forming a hook. The singular shape of the hemelytra, destitute of apical membrane, and void of wings, is also worthy of observation.

* Cheirochela is derived from the Greek χεὶρ, the hand, and χηλὴ, a claw.

LYSTRA. *Fabr.*

Lystra Æruginosa.

TAB. XXXI. fig. 1.

Long. lin. 13. Lat. lin. 4.

Viridis; alis anticis sordidè fulvescentibus viridi nigroque variegatis, marginibus externè atris. *Caput* viride, facie planâ, margine antico acutè curvato, carinâ frontali inter oculos cum margine antico parallelâ. *Alæ anticæ* sordidè fulvescentes, dimidio basali irrorato, maculâ magnâ rotundatâ ante apicem, apiceque nigris. *Alæ posticæ* albo-farinosæ. *Pedes* sanguinei.

Habitat in Agro Assamensi.

In Museo D. Hope.

APHANA. *Burm.*

Aphana Aurantia.

TAB. XXXI. fig. 2.

Long. corp. 9. Lat. lin. expan. alarum, unciæ 2 lin. 6.

Totum corpus suprà aurantium; alis anticis maculis flavis vix conspicuis aspersis, posticè nigro-maculatis, *margine interno* maculis nonnullis minutis notatis, *margine postico* tenuissimè nigro. *Caput* suprà excavatum, marginibus elevatis, fronte in cornu acutum supra prothoracem retroproducto. *Abdomen* basi albo-pulverosum. *Corpus* infrà concolor, paullò obscurius.

The above nondescript appears to be allied to *Aphana submaculata* of Westwood, a species accurately figured in the Naturalist's Library.

BOMBYCIDÆ. *Leach.*

Bombyx Spectabilis.

TAB. XXXI. fig. 3.

Long. corp. 1 unc. 9 lin. Expan. alar. unciæ 6.

Totum corpus suprà luteo-brunneum, maculis rivulisque nigris variegatum. *Alæ anticæ* integræ, concolores, *basi* rivulis octo nigris, *medio* magis

brunnescenti, lineâ nigrâ utrinquè valdè irregulari incluso, maculisque parvis nigris in nervos dispositis, *apice antico* lineis angularibus albis maculisque duabus majoribus nigris, *apice postico* rivulis decem nigris. *Alæ posticæ* dimidio basali nigro, apicali pallido nigro-rivulosis. *Antennæ* bipectinatæ, pectinibus mediocribus. *Palpi* parvi. *Lingua* spiralis. *Maxillæ* capite duplò longiores. *Corpus* infrà nigrum.

A more lengthened Latin description is unnecessary, as the figure is so accurate. I need only add, that the wings are of a most agreeable russet brown and cream colour, which being formed into the greatest variety of different shaped markings renders it almost impossible to describe the insect with any tolerable degree of accuracy. It seems probable that the present species will at some future time be considered the type of a new genus, as the anterior wings are laterally rounded and not scalloped, as is the case with several, if not all, of the African species belonging to this group. The only insect of my acquaintance with which it can be compared is *Bombyx Lucina* of Drury, from the vicinity of Sierra Leone.

Zygænidæ. *Stephens?*

Chelura.

Caput anticè angustum, posticè latius.
Lingua spiralis, subelongata.
Palpi breves.
Antennæ ante oculos insertæ, bipectinatæ.
Thorax connexus, magnitudine mediocri.
Abdomen subcylindricum, annulis ad apicem magnitudine decrescentibus, octono minori.
Cauda forcipe acuto armata, et in parte mediâ duplici hamo instructa.
Alæ angustæ, marginibus posticis subemarginatis.
Pedes simplices.

Chelura bifasciata.

Long. corp. lin. 11½. Expan. alar. 3 unc. 2 lin.
Straminea; antennis nigris, alis anticis binis fasciis aurantiis insignitis.
Caput nigrum, antennis concoloribus, thorace tuberculato glabro et nitido.

Abdomen annulis septem primis obscurè atris, octono rubro-piceo, caudâ concolori. *Alæ* pallidè flavæ, binis fasciis aurantiis notatæ, fasciisque nigris utrinquè positis. *Corpus* infrà nigrum, nitidum, ultimis segmentis abdominis forcipe hamoque aurantiis. *Pedes* picei.

This singularly-formed insect was captured in Assam by Mr. Griffith, and appears to be undescribed as far as I have had an opportunity of obtaining intelligence: respecting its habits little is known, and it seems doubtful with what family it is to be associated; for the present it is arranged with the *Zygænidæ*. It is probable that it ought to be arranged with the *Lithosiadæ*.

Zygænidæ. *Stephens?*

Eterusia*.

Alæ angustæ, integræ, nervo antico apicali trifurcato, nervo medio etiam trifurcato, furcis ferè rectis. *Alæ posticæ* breviores, integræ, cellulâ elongatâ, apiceque nervos ferè rectos emittente. *Antennæ* ♀ graciles, vix uniserratæ. *Lingua* spiralis, elongata. *Palpi* breves. *Abdomen* terebrâ parvâ exsertâ instructum.

Eterusia tricolor.

Tab. XXXI. fig. 4.

Long. corp. 10½ lin. Expan. alar. 2 unc. 8 lin.

Caput violaceum; alis *anticis* viridibus, variisque maculis albis notatis, *posticis* basi aurantiis, apicibus externè violaceis et albo-maculatis. *Caput* atro-violaceum, antennis nigris, subtilissimè serratis. *Thorax* niger, velutinus, anticè et posticè violaceo colore inquinatus. *Abdomen* aurantium, annulo primo violaceo. *Alæ* anteriores nigro-olivaceæ, virides, alboque maculatæ, posticæ basi aurantiæ, dimidio apicali, apicem versus violaceo colore tinctæ, maculisque albis insignitæ. *Corpus* infrà cyaneo-violaceum, segmentis abdominis albo nigroque alternè variegatis.

Habitat **in agro Assamensi.**

This insect appears to be a nondescript, and is one of the most beautiful in

* Eterusia, from the Greek ἑτερούσιος, qui alterius seu diversæ essentiæ.

colouring of my acquaintance: it is probably one of the genera of a family peculiar to the East Indies. Little is known of the Oriental *Lepidoptera*, excepting those described in the *Annulosa Javanica* by Dr. Horsfield, so much so that I hesitate in hazarding an opinion respecting them. It is almost impossible to describe the beautiful colouring of this lovely insect: the dye of the under wings is of a rich mazarine blue, which passes insensibly into violet and black. In affinity the genus is allied to *Campylotes* of Westwood, described in Professor Royle's work on the Natural History of the Himalayan Mountains. It is allied also to *Gymnautocera* of Guerin, and to *Heleona* and *Anthomyza* of the same author. It is doubtful if the insects composing this family are more allied to the *Zygænidæ* than the *Lithosiadæ*; they appear to have been greatly neglected, and it is the more remarkable, as they are certainly some of the most beautiful of the *Lepidoptera*.

Zygænidæ. *Stephens*?

Erasmia*.

Antennæ ♂ bipectinatæ, pectinibus mediocribus.

Alæ anteriores oblongæ, subovales, integræ, nervis posticis paullò curvatis, cellulâ discoidali clausâ.

Alæ posticæ subrotundatæ, nervis posticis curvatis.

Corpus gracile, subcylindricum.

Caput parvum, *palpis* parvis.

Lingua spiralis et elongata.

Pedes graciles.

Erasmia pulchella.

Tab. XXXI. fig. 5.

Long. corp. unc. 1. Expan. alar. 3 unc. & 2 lin.

Argenteo-viridis; alis anticis nigris, maculis viridi-cœruleo-argenteo ornatis, fasciâ irregulari ante medium rufâ, maculisque majoribus albis pone medium positis. *Alæ* posticæ stramineæ, basi apiceque nigris, nervis viridi-cœrulescentibus.

* Erasmia, from the Greek ἐράσμιος, amabilis.

The above insect is one of the most lovely in colouring of all the *Lepidoptera*. When viewed by individuals standing in a different light, the blue appears to one person to be of a vivid green, to another of a lazulite blue. I have had drawings made by different persons; the first contends that the colour is green, and the second that it is blue; in short, both are right; all depends on the situation in which the individual views the specimens.

EXPLANATION OF THE PLATES.

Tab. XXX.

Fig. 1. *Anoplophora Stanleyana.*
2. *Callichroma Griffithii.*
3. *Callichroma Cantori.*
4. *Oplophora Sollii.*
5. *Monochamus ruber.*
6. *Euoplia polyspila.*

Tab. XXXI.

Fig. 1. *Lystra æruginosa.*
2. *Aphana aurantia.*
3. *Bombyx spectabilis.*
4. *Eterusia tricolor.*
a. Head, and bar of antenna. *b.* Part of antenna. *c.* Apex of hind-wing. *d.* Fore-leg. *e.* Ungues.
5. *Erasmia pulchella.*
a. Head, and base of antenna. *b.* Apex of the fore-wing. *c.* Apex of hind-wing. *d.* Hind-foot.

XXVII. *Observations on the Cause of* Ergot. *By Mr.* John Smith, *A.L.S.*

Read November 6, 1838.

THE substance called Ergot being a production which has given rise to a diversity of opinions, in regard to its nature and origin, and the more than usual quantity this season on several species of *Elymus* and other grasses in the Royal Botanic Garden at Kew having attracted my attention, I was induced to examine it, and I beg to lay the result of my observations before the Linnean Society.

Ergot is well known to be a black fungoid-looking body, seated within the floret, and protruding beyond the glumes (in the manner of a spur) of many species of grasses, especially the Rye. DeCandolle considers it as a fungus, and refers it to the genus *Sclerotium*. Fries also includes it among fungi, giving it the name of *Spermoedia Clavus*, with the following generic character:—"Variable, rounded, entophytal, rootless; of a fleshy, mealy, homogenous texture, with a rind concrete, scaly, or somewhat pruinose. Proper fructification none." He concludes, however, by stating, that "it is only a morbid condition of the grain of corn, not propagated by seeds, but generated by a particular combination of external influences;" and observes that some consider Ergot to be caused by the puncture of insects. I had paid some attention to the subject for several years past, and from the circumstance of observing a peculiar species of fly settling on the ergot-bearing spikes, I was led to suppose that they were in some way instrumental in producing it; but what more particularly attracted my attention this autumn was, early one morning observing large drops of a brown-coloured liquid hanging from the spikes of an *Elymus*, which contained a number of full-grown ergots; and towards the apex of the spike, where the ergots were younger, I also observed nearly similar but more transparent drops.

This liquid in either state was found to be viscid, and of a sweet taste; and

as it has the smell of sugar and water, it occurred to me that the object of the fly's visits was to feed on this liquid. I collected part of this fluid in a phial, and on examining it in the microscope I found it entirely composed of myriads of generally uniform oblong transparent bodies, like sporidia of a fungus, slightly bent, with one indistinct spot near each end; these sporidia-like bodies freely dispersed on diluting the viscid fluid with water, but retained their forms: I at the moment considered them to be the sporidia of the ergot, and I was led the more to believe so, as on applying a drop of water to a full-grown ergot, multitudes of them became disengaged from its surface, and from the cracks or longitudinal fissures, which generally characterize the ergot, the water so impregnated having a milky appearance.

I also found the same bodies on the glumes and other parts, with which the liquid, having run, had come in contact, and which, when hardened by evaporation, gave the parts a dark appearance.

On further examination I found the same bodies on ergots of all sizes, even on the youngest, and on opening yet unexpanded florets towards the apex of ergot-bearing spikes, I frequently detected them on the surface of different parts of the fructification, especially on the anthers and ovarium, and in little clusters on the hairs and feathery stigmas. Many florets, however, were destitute of them.

Now as these bodies have been found to accompany the ergot through all its stages, and are present before the impregnation of the ovarium, at least before the discharge of the pollen, and, consequently, before there is any appearance of an ergot being about to be formed, they cannot be its seeds, but no doubt are in some way the primary cause of it; and it now remains to determine what these sporidia-like bodies are. On examining an ergot of *Elymus* (or of any other grass) before it has been moistened, its surface is seen to have a chalky or dirty white colour), which viewed in the microscope is seen like a thin crust having a pruinose snowy appearance, and readily separating on the least application of moisture into myriads of the sporidia-like bodies: on viewing this crust in a dry state, the pruinose appearance is seen to be caused by these bodies being joined together lengthways into slightly elevated spicula, and thus forming a crust.

On extending this examination to the anthers, where they appear to me first

to originate, I found the anther irregularly covered with numerous distinct, short, simple or ramifying articulated filaments, the articulations or side ramules being of the size and form of the sporidia; sometimes the filaments were more elongated and naked, or destitute of lateral sporidia. On examining a spike of *Phalaris aquatica*, in which the anthers had been developed, I found their withered remains adhering to the apex of the glumes bearing the same kind of filaments, but black by exposure; they gave out the same-shaped bodies in water, and on the glumes lower down there was a concrete chalky-like substance entirely composed of them: but the ovaries had yet no appearance of being ergotized, although ergots were found on other spikes of the same plant. From the above statement I am led to consider these bodies as the joints of a minute articulated fungus, which is developed in the early stage of the floret, and increases rapidly, ultimately forming a crust, and propagating itself by a total separation of the joints on the application of moisture; this, no doubt, impregnates the soil or adheres to the perfect seeds of the grass, which on germination and subsequent growth, carry up some of the reproductive matter of the fungus, which again developes itself in the anther*, where it may act with the pollen in the impregnation of the ovulum, causing a morbid growth of the albumen, which continues to swell, and forms an elongated oily fungoid body or ergot on which the minute fungus seems to originate. My conclusion therefore is, that Ergot is not an organized fungus, but the result of the action of a fungus.

List of Grasses on which Ergot was found.

Elymus giganteus.
——— sabulosus.
——— canadensis.
Lolium perenne.
Agropyrum maritimum.
——— caninum.
Dactylis glomerata.
Avena pubescens.
Arundo Phragmites.
Molinia cœrulea.
Milium multiflorum.
Arrhenantherum avenaceum.
Phalaris aquatica.
Phleum pratense, no ergot, but the fungus on the apex of the glumes.

* Similar to what Mr. Bauer has shown to be the way in which the smut, and grainworms of the wheat are propagated.

I had not the opportunity of examining the rye in a young state, but have found the oblong bodies on old rye ergots.

Note.—It is right for me to state, that when these observations were written I was not aware that much of what I have mentioned had already been noticed by earlier writers; for I find that so long ago as 1783, Tessier speaks of having seen the fluid hanging in drops from ergot-bearing spikes, and several succeeding observers notice the oblong bodies contained in the fluid, and which were by them considered as the sporules or seeds of the ergot. But the nearest approach to the correct view of the subject is given in the Transactions of the Linnean Society of Paris for 1826, by Leveillè, whose account differs but little from my observations. Leveillè is the first who distinctly states the oblong bodies (which are found accompanying the ergot) to be the seeds of a very minute fungus, to which he gives the very appropriate name *Sphacelia segetum*; and which fungus he regards as the cause of Ergot.

The question now is, in what way the ovarium becomes infected with this fungus so as to cause it to become an ergot? And although my observations (since my original paper was written) do not yet enable me to speak with certainty on this point,—yet, on viewing all circumstances, I am still induced to consider Ergot to be a constitutional disease of the plant, brought about by the reproductive matter of the fungus being absorbed during germination, and carried up by the fluids of the plant, and becoming developed in the fructification even before the opening of the floral envelopes,—but whether the ovarium is at this time infected with the disease, or whether it is communicated to it during impregnation from the already diseased anther, is a question still to be solved.

XXVIII. *Observations on the* Ergot *of Rye, and some other Grasses.* *By* Edwin J. Quekett, *Esq., F.L.S.*

Read December 4th, 1838.

HAVING heard the observations on the nature of Ergot, communicated to the Linnean Society on the evening of November 7, by Mr. John Smith, of the Royal Botanic Garden at Kew, and having been engaged previously in the same investigation, which has been directed not only to the cause but to the structure, growth, and manner of reproduction of certain bodies connected with the formation of this singular substance, it occurred to me that the following might prove an useful sequel to the former by making the history of this production more complete, and confirming some of the views therein expressed.

The investigation of this subject has often occupied the attention of both English and foreign botanists*, with the view of determining its nature and origin, yet notwithstanding the mystery belonging to it has not been completely

* A list of some of the foreign authors who have written on the nature of Ergot, whose works have been consulted :—

Tessier : *Traité des Maladies des Grains*. Paris, 1783.

DeCandolle : in vol. 2. *Mémoires du Muséum d'Histoire Naturelle*. 1815.

Desfontaines : in Trans. Acad. Scien. Paris. 1816.

Leveillè : *Mémoire sur l'Ergot* ; Ann. Soc. Linn. Paris, vol. v. 1827.

Philippar : *Traité Organographique et Physiologico-agricole sur l'Ergot, &c., dans les Cereales*. Versailles, 1837.

Phœbus : *Deutschlands Kryptogamische Giftgewächse*. Berlin, 1838. On whose authority the following are given :

Wiggers : *Inquisitio in Secale cornutum* ; Comm. præm. orn. Gott. 1831—4.

Diez : *Verss. uber die Wirkungen des Mutterkorns* ; Gekroute Preissch. Tub. 1832.

Dierbach : *Die neuesten Entdeckungen in dem Mat. Med.* I. 1837.

Etzrodt : *Das Mutterkorn* ; Inaugural-Abh. Würzb. 1838.

removed, the observations published by some of the later authorities have gone far towards our viewing this production in a clearer light, especially those of Leveillè, Philippar, and Phœbus, from whom we learn much interesting matter, and also the history and former hypotheses respecting the Ergot, which here will be omitted, for the sake of brevity.

On examining* the spikes of the infected grasses whilst recent, there could be observed lodged between the paleæ of the flowers (bearing ergots) a quantity of a viscid fluid, which appears to exude from them; and on others could be seen an appearance as if something slimy had once been smeared over them. On submitting the fluid to the microscope, it was found to be composed of an infinite number of particles, mixed with some liquid, and whose number alone appeared to cause its viscidity, the taste and smell it afforded being of a faintly sweet character, even when examined in minute quantities.

On examining the slimy appearances, which are of a darkish colour, that occur on certain paleæ of Elymus, Rye, and other grasses, the same numberless particles could be detected, when the viscid matter was dissolved that had fastened them to such a situation, which made it evident that these marks were occasioned by some of the viscid liquid having applied to these organs, and become dry from the loss of some portion of its watery constituents.

Having ascertained these facts, it was conceived that these minute bodies in the liquid were connected with the means by which the ergot was occasioned and propagated, and were considered to be the *sporidia* of some fungus: therefore, how the liquid was generated, formed the next step in the inquiry, as being an important part of the mystery.

This viscid liquid has been observed by most of the preceding investigators. Tessier, in his *Traité des Maladies des Grains* (1783, p. 37), speaks thus: "J'ai vu ainsi que quelques physiciens, sur des epis de seigle un suc visqueux, luisant, d'un goût mielleux, qui enduisait l'intérieur, l'extérieur et les arètes même des balles ou étaient renfermés des ergots naissans; mais plusieurs balles etant

* The observations that follow have resulted from the examination of some recent specimens of Ergot on the *Elymus sabulosus*, presented to me by Mr. John Smith, and from those on Rye and several other grasses kindly lent me by J. Pereira, Esq., being the first examples that I had the opportunity of examining in a recent state; having often observed the specimens in the state in which they occur in the shops without ever being able to make out anything satisfactory respecting this anomalous formation.

privées de ce suc, quoiqu'elles contenissent de jeunes ergots, je ne puis prononcer sur la cause qui le produit, ni sur la part qu'il a à la formation de l'ergot." From this it appears to be difficult to determine from whence the liquid escapes, and also it teaches us that it is not always present.

Leveillé in his *Mémoire sur l'Ergot* (Annales Soc. Linn. Paris, 1827, vol. 5, p. 570,) gives it as his opinion, that the presence of the liquid always precedes the formation of the ergot, and from other observations states, " De plus elles nous ont appris que ce suc est un champignon dont le mode de developpement, l'organization et les effets meritent la plus grande attention": this, however, does not determine its origin ; but (p. 571) it is stated, " Si ce champignon traverse les glumes sans éprouver d'accident, on le voit à l'extrémité de l'ergot, ou il forme un tubercule jaune." " Il laisse écouler un liquide visqueux :" here is stated the source of " a viscid liquid," which it is imagined is identical with the one under consideration, which is said to exude from the fungus at the apex of the ergot ; but it will be attempted to be shown hereafter that this considered fungus is in reality not one, but a portion of the diseased ovary ; therefore, if the fluid escapes from this, it in all probability has its origin in the diseased grain.

Philippar (*Traité &c. sur l'Ergot du Seigle*, p. 111,) inclines to the opinion of the internal origin of this viscid liquid in the following words : " En remontant à la source de ce liquide, on voit qu'il s'extravase d'un *centre floral*." (p. 115.) " La transudation du liquide cesse insensiblement et lorsque l'ergot a acquis tout son accroissement il n'y a plus de transudation." From these observations it appears that the liquid escapes from the ergot ; but still it would be a matter of some interest to ascertain the precise point from which it flows, and to acquire other information respecting it.

Having ascertained the healthy structure of the young grain, the observations were directed to the earliest appearance of the ergot ; and it was found that when influenced in its growth by the presence of a parasitic fungus (hereafter described), its healthy state was lost at a very early period, by the rapid germination of the latter, which, like others of its kindred, generated in a short time an inconceivable number of reproductive atoms.

The first appearance of the young grain changing from its healthy condition is manifested by its appearing swollen and softened, and possessing, as Leveillé and Philippar have described, a fetid disagreeable odour : in this state it breaks

very easily in a transverse or any other direction, on very little force being exerted for that purpose; it exhibits at this period, under the microscope, its surface covered with a white mealy coating, which is mixed with cotton-like filaments*, separating with the utmost facility when the ergot is placed in water and means are used for detaching it. This coating is not confined to the body of the grain exclusively, for the particles and filaments of which it is composed run over the anthers and stigmas, cementing them into one mass; this fact is mentioned by Leveillé, and figured by Philippar; the particles being found on the anther is noticed also by Mr. Smith, and they have been detected by myself on the glumes and paleæ.

This coating, when examined microscopically, is found to be composed of minute bodies (sporidia), which are seen separated from each other when they are removed from the ergot; but when viewed in their natural situation they are seen occasionally united by their extremities, forming short moniliform filaments; but for the most part they are found irregularly agglutinated to the surface, their connexion with each other being so easily disturbed if moisture be applied to them. The coating is not smoothly distributed as regards the surface it covers, but is composed of numerous flakes and also of sinuous ridges†, similar to the convolutions on the exterior of the human brain, which are arranged longitudinally upon the apex of the ergot, but diminish toward the base, and are most distinct when the specimens are about half grown.

At this stage the whole diseased grain does not measure more than one sixth or one eighth of an inch, and the stigmas have become somewhat shrivelled, whilst the few hairs on its apex, and also the two scales at its base remain unchanged. If a transverse section be made, it shows scarcely anything but sporidia arranged about a very small and soft axis, which is of a lobed, triangular, or irregular form; this axis is the grain very much altered from its normal condition, and presenting scarcely any analogy to the others which retain their healthy character.

* Besides these filaments, there are others which appear to me as if they belonged to some other parasite, which selects a damp situation for its growth, and have no share in the production of the ergot, their joints being not like those of the true coating, having seldom any granules within them, and being more nearly rectangular than elliptical, and occurring on many parts of the grass, and not always on the body of the ergot.

† See Tab. XXXII. figg. 4 and 7.

As the ergot enlarges, there does not appear to be a corresponding increase in the production of sporidia, but rather a diminution; for when it has attained a size sufficient to protrude beyond the paleæ, it has given over supporting any longer the increase of the reproductive particles which occupy its surface, and seemingly infected with something communicated by, or abstracted from, these bodies, grows with rapidity in a diseased condition, and in a short time emerges beyond the paleæ with apparently few of the sporidia on its exterior; those that existed in the young state being now either detached from external causes, or spread over a larger surface.

When a transverse section is made before the ergot protrudes beyond the paleæ, its consistence is found to have become more solid, still, however, presenting a sinuous or lobed margin; and immediately within the external border, which is composed of sporidia agglutinated to the diseased grain, there begins to appear a purplish line, which is gradually shaded off inwardly till it merges into a brownish white centre.

After the ergot has shown itself beyond the paleæ the growth is still rapidly proceeding, and it soon attains a size varying in different grasses from a fifth of an inch to one inch and a half. This part of the growth is accomplished in a very short period of time, as Philippar mentions that he observed some particular ears of rye having no visible ergots, when in eight or ten days subsequently he found the same plants had then perfect ones upon them. At this period its surface begins to be deprived of the white coating of sporidia, a few only remaining in flaky patches, which give to it the "sub-pruinose" appearance mentioned as one of the characters of the genus *Spermoedia*, and the purple coat that formerly was concealed underneath it, is now its outermost covering, and begins to lose its lobed and furrowed surface from being distended by the development of the central part: at this period, though the ergot is in a great part exposed, it has not lost all traces of the stigmas or of the scales, but they are now become shrivelled, and its apex is surmounted by an appendage* (to which Phœbus applies the term "*mützchen*," bearing the remains of the hairy crown observable on the healthy grain, and which Leveillé considers as the fungus which produces the ergot.

The transverse section at this period presents a firm slice, which, when

* See Tab. XXXII. fig. 9.

viewed as a transparent object with a low magnifying power, exhibits a granular centre surrounded by a purplish border: the longitudinal section shows the same granular appearance along its middle part, bounded also on either side by the purple border. There is now something deceptive about these objects if immersed in water, there being then observed issuing from them myriads of minute particles resembling sporidia, which completely fill the field of view. These however are not sporidia, but particles of an oily nature, together with certain other granules the cells contain (analogous to those found in the healthy grain with the fecula), which now float out from the divided cells, and may be readily taken, as they were by Philippar, for sporidia, if the magnifying power be not sufficiently distinct and powerful.

As the ergot approaches maturity its colour becomes dark purple*, and its surface generally presents many cracks and fissures: its shape at this time is subject to much variation, being generally elongated and tapering away at each end, sometimes occurring quite straight, at others slightly or very much curved, there being besides these many other forms of length and thickness constantly observed; its section transversely is more or less triangular, and presents a furrow on one or both sides, especially in the rye, though these are not discoverable in the ergots of all grasses.

When the ergot has arrived at its perfect development, it still retains in those specimens that have not been exposed to injury the appendage at its apex, a few hairs surrounding the remains of the stigmas, and likewise the two scales at its base, which appear but very little changed, and its surface has now become almost deprived of sporidia.

It appears from the examination of the healthy grains of rye that the ergot corresponds to the seed without its pericarpial covering; for it is found that the grain of the rye has two distinct layers for its pericarp, the outer being very thin and composed of elongated cells, whose longer axis is perpendicular, and the inner of elongated cells also, but the longer axis is horizontal: within these two layers is a line of some width, which is coloured of a reddish brown tint and connected by its inner side to a layer of cells, which have somewhat

* In several instances ergots have been found not of a violet black colour, but of different lighter shades, and even of the colour of the healthy grain.

the arrangement of the stones which form the arch of a bridge. This coat appears to answer to the testa of the seed, and also to the external or purple one of the ergot, the colouring matter it contained having assumed a deeper shade: this is made probable as there is observed on the exterior of some ergots what appear to be the remains of the pericarp, which adheres in irregular little filmy pieces, and are occasionally seen external to the purple layer when sections are viewed under the microscope with strong powers and transmitted light, as in Tab. XXXIII. B. fig. 1. This happens when all the pericarp is not lifted up on the apex. Leveillé, however, and some others have not been able to discover any coat; for the former (*op. cit.* p. 573.) says, "On ne remarque pas de membrane à sa surface: les auteurs disent qu'il n'en existe pas, et en effet nous n'en avons jamais pu demontrer l'existence."

On applying very high magnifying powers to thin sections of the central part the structure is seen to be distinctly cellular, the cells however being very small, and in the rye about four times less than those of the healthy grain. Their arrangement is by no means regular, there being many variations in shape and size, as in Tab. XXXIII. B. fig. 1., which is a transverse slice, but in the longitudinal (fig. 2.) they have a greater tendency to be arranged in rows. Their contents likewise vary, some cells having one granule, apparently of an oily nature, which completely fills them, as in figs. 1. & 2.; others having two or three small ones, placed sometimes in the centre, as Phœbus observed; and others having granules which appear not oily, but very like the minute particles that are seen to be mingled with the fecula in the healthy grain.

The purple coat is not, as Phœbus figures it, composed of elongated cellular tissue, but of minute square cells, arranged in longitudinal rows between striæ or thicker places in the covering of the ergot, which may easily be mistaken for elongated cellular tissue, if a very high magnifying power be not used in the observation.

The terminal point or cap of the ergot, when examined microscopically, appears to be a heterogeneous mass of structure; being composed externally of the cerebriform coating of withered pericarp and of the sporidia, which cements together the various hairs that are found on the exterior of the grain, and which incloses likewise what is conceived to be the remains of the peri-

carp, which has been lifted up to this point by the seed in the interior putting on a state of development incompatible with the usual growth of that part. It has now become shrivelled from no longer containing the seed, and presents to the view a mass of broken-down porous tissue, so much so, that no regular structure can be made out of this as out of other parts of the diseased grain, though Leveillé mentions there are four or five parts radiating from the centre, but these appear nothing but those caused by its shriveling.

The proportion this appendage bears to the ergot is subject to much variation, as in the *Elymus* most frequently is found nothing beyond a tuft of hairs precisely such as exist on the healthy grain; but occasionally there is some remaining part of the pericarp, which is variable in size. In the rye the appendage is generally of about the same size, viz. one sixth or one eighth the length of the ergot, and appears to consist mostly of shriveled pericarp, on the apex of which is occasionally a sunken depression and a few rigid hairs surmounting it: when the pericarp is not lifted up by the seed within, the appendage is smaller, and occasionally some fragments of what appear pericarpial covering can be detected on various parts of the body of the ergot.

Thus it appears that this appendage is formed by the pericarp not growing so fast as the seed in its interior, thereby becoming torn asunder; still maintaining some adhesion, it becomes lifted up to the apex of the ergot by the great elongation of the seed, not always being central, often on one side, and its base strained over the apex of the ergotized grain, and not partaking of the nature of a fungus, as Leveillé imagined.

The number of ergots in any one spike of a grass is subject to much variation; in *Elymus sabulosus* there occur a great many, but in the smaller grasses only one or two, and in the rye the number seldom exceeds five or six. The appendage that each possesses in its perfect state is scarcely ever to be found existing on those specimens which are sold in the shops, being generally rubbed off in the collection of the specimens.

On pursuing the examination on the sporidia that exist on the exterior of the ergot, they were found to be of a lengthened oval figure, having their sides occasionally a little contracted about midway, of the forms represented at Tab. XXXIII. B. fig. 3.; there are, however, some variations in shape, some being nearly round, and others being longer than those in the above figures.

The size of the reproductive bodies is excessively minute, being not more on the average than the [illegible]th part of an inch long, and the [illegible]th part of an inch in diameter; some few however being much smaller, and others larger than these dimensions.

Their number on one ergot, perhaps, is more astonishing than their minuteness; for by immersing in water a full-sized specimen from the *Elymus* when copiously covered, and making use of means for detaching them, a film was obtained which thickly covered more than a square inch of surface; consequently from a rough calculation there could not be many less than twenty millions of sporidia on this specimen, supposing the film was only one layer in thickness.

When these minute bodies are moistened with water and magnified about 500 to 600 times linear, their structure becomes just discernible, and there can be observed in their interior a rounded nucleus or granule, or sometimes two or three such, which are of a greenish colour*; very seldom it is that there are more than three; and occasionally sporidia will be found that do not contain any granules: all of which varieties are mentioned and accurately figured by Phœbus in his account of these bodies, and their dissimilarity as well as their containing small corpuscules caused him to doubt their being fungic sporidia.

The size of these granules was generally about one eighth or one tenth that of the body containing them, and may be calculated to be about [illegible]th part of an inch in diameter.

Having kept some sporidia on a moistened glass, evident proofs were seen in a short time of incipient germination; and Philippar mentions, that when he moistened cloth and strewed sporidia upon it, they presented the appearance of having germinated: to examine this fact more perfectly, some of these bodies were placed on a slip of glass, moistened with distilled water, and covered with a thin plate of mica, and it was found immediately that a movement existed among them, such I considered as was discovered by Mr. Brown to exist amongst all fine particles, whether organic or inorganic, when placed so as to have free motion in water; the sporidia under observation never

* The green colour is owing to the minute body decomposing the light.

leaving the field of view, but possessing a tremulous movement, slowly approaching and retreating about their neighbours.

Having witnessed this for some time, and satisfied myself that the movements were such as are common to particles known as "active molecules," the object was set aside, covered with the piece of mica used in the previous observation, and placed under an inverted glass to prevent the evaporation of the water.

On examining it the next day, it was found that a few still retained similar movements to those witnessed the previous day, but the greater number presented appearances of commencing germination, in the various ways which here follow.

The most common method is that of the sporidia emitting a tube or tubes from some uncertain point or points (Tab. XXXIII. B. fig. 4.), but generally opposite the spot where a green granule is lodged in the interior. This tube increases to an uncertain length, and contains throughout its interior similar granules, arranged at short but generally equal distances between diaphragms, about as far from each other as they are in the interior of the sporidia; these tubes ultimately separate into fragments constituting as many fresh reproductive bodies.

In many other instances the sporidia, instead of producing a tube, give origin, opposite one of the granules, to a minute bud; this little point increases, becomes hollow, and ultimately separates from the parent as a perfect sporidium, frequently however before its separation showing an indication of producing a similar one from itself. (Tab. XXXIII. B. fig. 5.)

Another method of increase amongst these singular germs is that of the membrane composing the parietes of one of the sporidia breaking down, forming a flat patch, which keeps extending in all directions for a certain period, and developing upon itself granules, similar to those contained in the interior of the sporidia (fig. 6.).

The last and most remarkable manner of growth is that of the sporidia having a septum formed transversely across their interior, by a green granule extending itself laterally, and dividing them into two parts, each of which becomes again divided by a similar process; different states of which are represented in Tab. XXXIII. B. figg. 7, 8, & 9. By a repetition of this and other

A

Franz Bauer 1839

B

methods there at last is formed a moniliform filament, which, though simple in its origin, ultimately becomes branched, the branchlets most commonly having a centrifugal development, radiating* from a central collection of cellules, and giving off innumerable joints, which become perfect sporidia (Tab. XXXIII. B. fig. 9. and 10.), which commence again the several methods of germination just detailed.

These granules appear important bodies, resembling probably the nature of the *nuclei*, which were first discovered by Mr. Brown in the cells of various organs, and since called *cytoblasts* by Schleiden in his description of *Phytogenesis*; and these different methods of germination afford good illustrations of the manner of the formation of cellular tissue; and occasionally it happens that three of the methods, viz. pullulation, division, and the emission of tubes from the sporidia, may be detected in different parts of one little plant at the same time, as in Tab. XXXIII. B. fig. 9.

Whilst witnessing the daily increase and manner of development of this singular plant, an extreme number of green granules alone presented themselves, which had collected into one spot near the upper edge of the glass on which they were placed, and probably from being different in specific gravity from the water, had so collected by the glass having been kept in a position favourable for their so doing. These granules were about the $\frac{1}{10000}$th part of an inch in diameter, and possessed the movements of "active molecules," which was of greater range in proportion to their size than that observed in the sporidia before mentioned. On applying the highest magnifying powers it was found that these granules were similar to those in the interior of the sporidia, and sometimes were seen singly, at other times two united, and in a few cases three connected in a line, as at (Tab. XXXIII. B. fig. 11.). Being at a loss to conceive how these granules could escape from the body containing them,

* The radiating and moniliform character observed in this little plant, I consider is particularly owing to the manner in which it has been caused to grow; for being covered by a piece of mica, the sporidia or joints as they have formed have not been exposed to any cause likely to disturb the slender union they have with each other; and in this way they assume a condition which is unnatural, as on the ergot the articulations are scarcely ever found combined. I have noticed the same fact with *Torula cerevisiæ*, which has been made to grow without being disturbed, when a long string of sporidia could be seen, and with a slight agitation of the liquid not more than two or three could be afterwards found united.

some observations were made to discover the method, and it was found that very many sporidia did not emit tubes or germinate in any way, and evidently exhibited indications of the membrane which formed their parietes being injured and broken down, thereby allowing the granules to escape.

These atoms thus set at liberty, collected, as described, and could be seen singly, in pairs, or in threes; anxious to watch the changes these minute particles would undergo, they were daily examined for the space of seven or eight days, and it was observed that they ultimately appeared to become bodies like sporidia. During the first and second day no change was observed, but after this their margins could not be so well defined by the microscope, owing to a minute halo each presented: this I conceived originated from a glutinous exudation around the granule, which ultimately would harden into membrane and become the coat of the new sporidium: in this I was not mistaken, for after some days their size increased, and gradually appeared to approach the condition of other sporidia; those commencing with two granules had the appearance of two nuclei, those with three and one having their respective numbers also.

In this manner has been witnessed, by daily examinations, the growth of these sporidia, which, *being found on the ergot of every grass yet examined*, are without a doubt connected with the cause of its origin; the observations point out their various methods of germination, their advancement to maturity, and their ultimate production of the means of their increase; the little radiate plant seldom measuring more than $\frac{1}{200}$th or $\frac{1}{400}$th part of an inch in any direction.

From these observations the opportunity has occurred of confirming the fact, that this fungus is capable of existing when separated from the grain, not requiring that organ exclusively as its matrix, which fact was observed by Mr. Smith; the inference from which must be that the ergot can no longer be considered as a perfect fungus, but a diseased grain, as Leveillé described, though he somewhat erred in the nature of its production. The external appearances furnish the same proof, as at its apex can be seen the hairs that exist on the healthy grain, and occasionally also the remains of the styles; at its base is observed the pedicel, still supporting the two scales, consequently the intermediate portion is in the position of the body of the grain, and the

ergot that occupies this position ought to be certainly no other than the grain, which now differs from its healthy condition, from having in its early state supported a parasite which has communicated to it some disease, thereby perverting the normal state of its structure and development.

Notwithstanding the several parts of the grain are arranged as described, previous investigators, with the exception of Leveillé, have fallen into the error that the ergot was the fungus itself. Philippar appears to have viewed the matter in this light; still his expressions are somewhat vague respecting it, for (p. 122, *op. cit.*) it is stated, "Le grain ergoté, composé d'une substance fongique tassé et très étroitement serré, est le réceptacle des séminules, des globules ou bourgeons reproducteurs du champignon." In the same page the following expression is used: "le champignon"—"sortant de l'intérieur de la plante par le rachis ou l'axe des épillets du point réceptaculaire des organes sexuels." And lastly (p. 123), his opinion is given thus: "De tout ceci, je conclus que l'ergot est l'appareil reproducteur du champignon, qui termine ainsi sa végétation."

The reasons assigned by Philippar for considering it a fungus arise from its situation and from the microscopic examination of its structure, which he describes (p. 113) as beginning in the receptacle of the flower, and lifting up the sexual organs which become diseased but still remain on its apex. It is found, however, that where the paleæ are attached, and also the two scales, this part, which must be a receptacle also, is not diseased, as these organs remain undisturbed; consequently, it can only be the point where the grain and the receptacle unite that could give origin to any body taking the position occupied by the ergot. Yet from this point, which is firmly connected with the structure of the young grain, it is most singular that in every kind of grass yet found ergotized this supposed fungus should always burst through the tissue at that particular part, and at that particular time when the flower is about to expand. If it be a fungus, it ought also to burst forth as an ergot from the stem or some other place on the several grasses, besides growing between and parting asunder two organs, which were as firmly united to each other, in the young state, as the capsule of the poppy is to its flower-stalk: moreover, the ergot when matured, like the grain when ripe, slips out of the paleæ as a ripe filbert from its cupule, showing that it has no more organic

connexion, at this period, with the receptacle than the grain itself possesses.

Philippar's examination of the internal structure appears to have strengthened his view of its being a fungus; for he describes the body of the ergot to be composed internally of branched short fibres and globules of various sizes, round and oval, which he believes to be the means of its reproduction. My own observations on the internal structure differ somewhat from this, by proving that the fibres described are the boundaries of irregularly-sized cells, and not fibres at all; and the globules are not reproductive bodies, but for the most part those of a fatty oil and some other granular matters, which are contained in the interior of the cells, as seen in TAB. XXXIII. B. fig. 1., which is a transverse slice magnified six hundred times. In truth I have never seen sporidia in the interior of the ergot, if care be taken to exclude those on the exterior.

To witness these facts, take an ergot of rye, scrape away all its black coat, so as to remove all the sporidia which adhere to its surface; then make some very thin transverse slices, and let them be put on a slip of glass under the microscope; when water is added to them it speedily becomes turbid or milky, on account of the numerous particles that have escaped from the cells: these particles, however, are not *heavier* than the water, as the sporidia are, but are *lighter*, and collect on the surface, from whence they can be removed, like cream from the surface of milk. When magnified, they are found to be of very many sizes, some as large as the thousandth of an inch in diameter, and others so small as to be scarcely visible by the highest magnifying powers; when magnified about six hundred times their appearance very much resembles the globules seen in human milk. When the matter containing the fatty particles is heated, these minute globules liquefy, running together and forming either very large globules or numerous irregular masses, their primary form by this operation being completely disturbed, which would not have been the case had they been "séminules" or reproductive agents, as Philippar describes. To observe the structure of the cells, let some thin slices be made, and boil them in ether, which dissolves the fatty matter, and renders them transparent, so that the irregular cells can be readily examined, and by adding water afterwards to the ether a pellicle of fatty matter can be seen floating on the liquid.

Another argument against the ergot being a fungus is, that the reproductive particles are most numerous when it is young, and it continues its growth after their production has ceased, which is contrary to the usual law amongst that class of vegetable beings; for their efforts to live are only to develop the means of their propagation, commencing to decay the instant this act has been accomplished.

Besides these proofs, chemical analysis shows its dissimilarity in composition with *Fungi* generally, and even with the species of *Sclerotium* (a genus to which the Ergot was assigned by DeCandolle and Fée) on account of its containing very different constituents, the following being those given by Vauquelin in his analysis of the Ergot:—

Colouring matter: soluble in alcohol.

White oil: very abundant; sweet.

Violet matter: soluble in water.

Fixed phosphoric acid.

Azotized matter: very abundant, and alterable.

Free ammonia: at 100° Reaumur.

The fact of having caused the sporidia to grow unconnected with the ergot, and without assuming any form in the least degree analogous to it, is another, and the most substantial and convincing proof that the sporidia do not belong to that body, but are joints or portions of microscopic plants, which select the grains of many grasses as a suitable matrix for their development. There are other proofs of the separate existence of this microscopic plant; for it is not found exclusively on the body of the grain, but has been observed to flourish on other parts of the same grass, but occasioning in such situations no exuberant growth, for obvious reasons, because these parts have completed their development before the fungus makes its appearance; and their structure is not like that of the grain, which, at the period of attack, is exceedingly young, and, commencing to grow rapidly, is susceptible of impressions which can easily pervert its form and structure.

After numerous examinations respecting the nature of the Ergot of rye, and comparing the results with those obtained from other grasses* similarly af-

* The following are the grasses that have been examined when bearing ergots; most of the lower ones on the list were obtained in the neighbourhood of Greenwich:—

fected, it is conceived that the foregoing remarks have demonstrated that this body is produced by a particular species of fungus, which develops itself when it occupies the grain (whilst young), causing its remarkable alteration in form, colour, chemical composition and properties.

The manner in which this singular production probably originates (for at present much respecting this part remains uncertain) is, that the sporidia, or more likely the nuclei within them, are by some means introduced into the interior of the grass* and ultimately arrive at the grain, which they find the most suitable matrix for their development; or they may be brought into contact with the young grain from without, probably by the viscid fluid, but this is less likely to be the case, as the ergot can be detected before the paleæ have opened to admit the fluid.

When, however, they have been brought into contact with it, they lose no time in the work of reproduction, finding their way to the exterior, covering its body with multitudes of sporidia, and communicating disease to the healthy tissue, and thereby destroying so much of the coats as in the perfect grain constitutes the pericarpial covering.

Secale cereale.	Triticum repens.	Festuca pratensis.
Elymus sabulosus.	Dactylis glomerata.	Melica nutans.
Hordeum pratense.	Lolium perenne.	Alopecurus pratensis.
——— murinum.	Arundo phragmites.	

Phœbus gives a more extensive list than the above, amongst which he enumerates several kinds of *wheat, barley* and *oats* similarly diseased, together with some Cyperaceous plants.

* It is stated by Phœbus, and by Christison in his Treatise on Poisons, 2nd edit., that Wiggers had produced ergots by infecting the healthy grains previously with the sporidia. Leveillé also states (p. 570, *op. cit.*), "M. Simonnet s'en est assuré par une expérience très-simple, qui consiste à percer avec une épingle la partie inférieure de chaque fleur qui contient ce suc. Constamment cet observateur a vu l'ergot s'y développer." This last experiment is not of much value, for it generally happens that where the viscid juice exists there will be an ergot, whether a puncture has been made or not: the experiment ought to have been performed on those grains not moistened by any viscid juice.

Mr. Bauer (Penny Mag. 1833, p. 126 and 182,) has shown from interesting and delicate experiments, that the "smut-balls" on corn can be certainly produced by inoculating the seeds before sowing them with the sporules of the fungus producing such effects, viz. *Uredo fœtida* and *segetum*; and this excellent observer has proved that these bodies are carried into the interior by the sap after being absorbed by the roots, and it appears the most probable that the same takes place in the production of the Ergot.

Their presence* communicates disease most frequently to the entire grain; occasionally, however, only part of the albumen is attacked, and Tessier mentions this fact in these words: "C'est que la portion ergotée qui fait tantôt la moitié, le tiers ou le quart, est la plus voisine du support de l'épi et se trouve inserée dans la balle, occupant la place du germe au lieu que la portion semblable à du seigle est à découvert et la plus éloignée du support." These observations prove, from the position of the ergotized portion, that internal causes were more likely to effect such than external ones, and would countenance the opinion that the embryo was in such cases the part diseased; but these examples are so rare that that supposition cannot be maintained: on the other hand, it is to be remarked, that no trace of the embryo exists in the perfect ergot, and if it could have ever been impregnated, it must have been as speedily destroyed; and it is most likely that the grain is never impregnated, as the disease can be detected before the pollen is emitted; which fact coincides with Leveillé's observations, who says (p. 571.), "Souvent on rencontre les anthères collées à la surface; elles sont entières, linéaires, leurs loges *fermées* et remplies de pollen; circonstance, nous avons dit, qui avait été observée par Aymen et Beguillet, et qui prouve que le développement de la sphacélie précéde l'anthèse."

The diseased action thus engendered frequently destroys the vitality of the grain at the outset, so that it is unable to live under the effects produced by the fungus; specimens being sometimes found as if smothered by its rapid growth: when, however, the grain is not deprived of life, the diseased action vitiates all its constituents, and the perfect ergot soon takes the place of the healthy ovary, containing neither starch nor gluten, but an abundance of oily matter and other substances of a peculiar chemical nature.

From many experiments and examinations that have been made and repeated again and again, in order to obviate every source of error arising from

* I can see no objection to the supposition, entertained also by others, that there may be numerous kinds of parasitic plants whose germs arrive only at maturity in the interior of others, and which may be called *Entophytes*, which, like *Entozoa*, may have the power of selecting different organs as places of development, some choosing the stem and the leaves, and others the organs of reproduction. It is not to be conceived how so many fungi develop under, and then burst through the epidermis of many parts of plants, if this be not admitted.

the manner in which they have been conducted, it is considered the body known as an ergot may be defined to be *a substance composed of the diseased constituents of the grain occupying the position of the healthy ovary.*

Perhaps no vegetable substance has given rise to so many different opinions as to its cause as the Ergot. The earlier investigators supposed it to be owing to the puncture of an insect, and also to excessive moisture; some supposed it a habitation for living creatures; others followed, who considered it a fungus, which was called *Clavaria Clavus* by Münchausen, *Sclerotium Clavus* by DeCandolle, and lastly, *Spermoedia Clavus* by Fries, the same view being also entertained by Philippar. The "*Mémoire sur l'Ergot*" by Leveillé certainly approaches nearer the truth. He describes the Ergot as a grain diseased by a certain fungus, which he denominates *Sphacelia*, and assigns to it the characters given below*; still this intelligent observer is in error when he supposes that the appendage at the apex of the ergot is one of the conditions of the fungus, instead of being composed of the remains of the pericarp and hairs belonging to it, together occasionally with the remains of the styles; or, to use his own words, "Si ce champignon traverse les glumes sans éprouver d'accident on le voit a l'extrémité de l'ergot, ou il forme un tubercule jaune dont la consistance, le volume et la figure sont extrèmement variables."

Phœbus, the latest authority, considers the ergot to be the albumen altered "wir dürfen sie [Mutterkorn]" also "wohl für ein alienertes Eiweiss halten" (p. 104), and consequently to be a morbid grain of rye (p. 105), but denies that the "Blaschen" can be sporidia of a fungus, since they are of variable size and contain other smaller bodies.

From the foregoing observations it must be evident that the nature of an ergot is becoming better understood, from its origin being relieved of some of the obscurity that has hitherto enveloped it; therefore the former received opinions

* "Sphacelia. *Fungus parasiticus, mollis, viscosus* (forma indeterminata) *gyris exaratus, ex* 3 *vel* 4 *lobis apice connatis basi divisis et in axim confluentibus, constans. Sporulis globoso-ovatis nidulantibus.*"

"*Vere, in germinibus variarum graminearum, crescit, et præcipue secalis cerealis.*"

"Sphacelia *segetum* N. An eadem in omnibus gramineis?"

"Apicem germinis occupans, sphacelia fecundationi obstat, tamen ovarium crescit, sed gallarum more, et, pro forma elongata et curvata sub nomine *ergot* vel *clavi* designatur."

respecting it will now be untenable, and it will be requisite to correct also the botanical relations of this body, in order to assign to its assumed cause a position amongst the lowest of the divisions of *Fungi*.

On comparing the characters of the minute parasite of the ergot with those of British and foreign genera to which it is allied, it has been found so unlike any of them, as at present constituted, as to deserve being made a new genus, to which I have given the title of *Ergotætia** ; and after repeated examinations of the Rye and other grasses, I have not hitherto found any material difference in its organization or characters to warrant the making of those belonging to different grasses into different species ; therefore I adopt the specific term *abortifaciens*† for the fungus found on the rye, and believe those on other ergotized grasses to be of the same species, when the ergots are of a similar character.

This minute plant, from its structure and habit, will be classed among the *Fungi*, and placed in the suborder *Coniomycetes* of Fries, and in the tribe *Mucedines*, or in Berkeley's arrangement of British *Fungi* in the tribe *Sporidesmiei*, which comprehends those genera which have their "*sporidia chained together into flocci at length free.*"

The British genera of this tribe are three,—*Aregma*, *Torula*, and *Spilocæa* ; the first of which has sporidia opaque and pedunculated, whilst in the present plant they are transparent, and without peduncles ; the second differs by having its sporidia filled with a grumous mass, whilst the plant under consideration has one, two, or three well-defined granules in their interior ; and the last does not show the sporidia arranged in moniliform filaments.

The characters by which the plant may be recognised are the following :—

Ergotætia. Sporidia elliptical, moniliform, finally separating, transparent, and containing seldom more than one, two, or three well-defined (greenish) granules.

E. abortifaciens. (Characters as above.) Vide Tab. XXXIII. B. fig. 3—11.

* Derivation from *Ergot*, Fr. (Ergota *Pharm. Lond.* 1836), and *αἰτία*, *origo*.

† When this paper was read before the Society, the specific name used was *abortans*, which was intended to apply directly to the fungus destroying the germinating power of the grain, and indirectly to the more remarkable properties of the ergot. This term, however, is not grammatical, and by the suggestion of J. Pereira, Esq., the present one has been substituted.

There is a point which, as regards the medicinal properties of the ergot of rye, is deserving of being mentioned in this place, from having found in numerous instances that the specimens obtained from various grasses have frequently been not much more than hollow cases, instead of being solid. On looking for the cause, it was found that this excavation had been effected by numbers of a small species of *Acarus* (Tab. XXXIII. B. fig. 12.), which had devoured the interior; consequently, if the medicinal virtues reside in that part, which however is disputed, the specimens must become inert. The destruction that these tiny creatures make will become apparent by the following statement obtained from a friend, viz.: that from six pounds of ergot of rye, kept six months in the same paper, six ounces of powdery excrementitious matter was obtained; therefore the practice of keeping camphor with the ergot is likely to prevent the attacks of these minute depredators.

EXPLANATION OF TAB. XXXIII. B.

Fig. 1. Represents a transverse section (*extremely thin*) of the body of the ergot, magnified seven hundred times, exhibiting irregular-shaped cells, containing granules of various sizes, and the purple envelope, with some membranous portion adhering, probably remains of pericarp.

2. A longitudinal section of the same, showing also the granules contained in the cells, the latter appearing to be disposed in somewhat regular rows.

3. Shows different kinds of sporidia, which contain granules of various numbers, the first having none.

4. Represents their germination by emitting tubes which contain granules similar to those in the interior of the sporidium, from which they arise.

5. Is the manner of germination, by giving off minute buds, which ultimately become sporidia, four, five, or more, adhering occasionally together, and finally separating.

Fig. 6. Shows the membrane of one of the sporidia, laid open, increased in size, and developing granules on various points of its surface.

7. Shows the manner in which the sporidia become divided by a septum or septa, by the granules extending themselves transversely; different stages being observed in the first and succeeding ones.

8 & 9. More advanced states of growth.

10. The fungus, assuming a radiating form, and developing sporidia upon its branches.

11. Granules from the interior of the sporidia, arranged singly, or in twos or threes. All the preceding figures magnified seven hundred times.

12. The Acarus, which lives on the interior of the ergot, magnified fifty times.

XXIX. *On the* Ergot *of Rye.* *By* Francis Bauer, *Esq., F.R.S. & L.S.*

Read January 21st, 1840.

THE existence of this most remarkable disease in gramineous plants, particularly in Rye, has been known from time immemorial. Many authors, both ancient and modern, have written much on the subject of Ergot, but they considered it with reference only to the injurious effects which it has on the animal health.

The Abbé Tessier in his *Traité des Maladies des Grains*, published at Paris in 1783, gives an account of many important, and, generally speaking, very satisfactory experiments, as well by chemical analysis of the substance of the ergot of rye, as of the pernicious effects it has both on the human species and on brutes; but the opinions held on its nature and origin are to this day very unsatisfactory.

After more than twenty-five years' attentive observation, I am convinced that these opinions and conjectures are totally erroneous and without foundation.

The difficulty of tracing the origin of this disease undoubtedly arises from the fact, that not the slightest indication of its existence is observable either in the infected ear or in the plant till the ergot actually emerges from the husk in which it is formed, when it is too late to determine its origin.

It was about the middle of August 1805 that this disease came first under my observation, but then the rye was nearly ripe and the ergots full grown; consequently I could form no judgment: and it was not till the middle of June 1809 that I was enabled to prosecute and complete my investigation, at least so far as to ascertain *what* the ergot really is.

The rye was then just in blossom, but there being no external appearance of

the disease in the plant nor ear, however strongly infected, it required considerable trouble and patience to unravel every floret of the ears, which can only be taken up at random; from what I then observed I was soon convinced that the ergot is not an extraneous substance, as some have supposed it to be, but that it really is a monstrosity, or transformation of the embryo, and particularly of that part of the embryo which Gærtner calls the *Scutellum*; however, to make my illustration on that point more comprehensible to the general reader, I consider it necessary to explain the progress of vegetation of the grain. A sound germen of rye, before fecundation, consists of a pulpy cellular substance, enveloped in a delicate membrane, which forms the outer coat of the ripe grain; and in the middle of this cellular substance is a small cavity, lined with a dark green membrane, from which some mucous fluid seems to exude, but no traces of organization are at that time observable. At Tab. XXXII. fig. 1 is a sound young grain, about four days after fecundation, consisting chiefly of the same internal parts and substance as those of the germen before fecundation, but its shape is considerably altered, being much longer, and of a more oval form; the internal cavity with its green membrane is considerably enlarged, and the organization of the embryo is visibly advancing. At Tab. XXXII. fig. 2 is a side view of a longitudinal section of this young grain; at its base appears the first formation of the embryo, which then consists of a soft substance: in this figure and in fig. 3 the scutellum is visible, which is the first part of the embryo formed in all gramineous plants, and which in the diseased grains ultimately becomes the ergot. Tab. XXXII. fig. 4 is a front, and fig. 5 a back view of diseased grains from the same ear, and of the same age as the sound grain in figs. 1, 2 and 3: but its exterior shape is now greatly changed; the external membrane at the apex of the grain is much shrivelled and contracted, and at fig. 7, which is a side view of a longitudinal section of the same grain, the pulpy cellular substance is also much shrivelled, the internal cavity is much contracted, and the young ergot begins to be formed in the same spot as the scutellum of the embryo in the sound grain, and at that period the young ergot retains still some resemblance to the form of the scutellum of the sound grain (see Tab. XXXII. fig. 7 B., and fig. 8, which is more distinctly seen: the substance of this young ergot is at that period also very soft, of a white colour

internally, and surrounded with a light shaded purple ring, but is without any external membrane or integument, or internal fibres or vessels, which is also the case with the scutellum of the embryo of the sound grain.

In fig. 9 is a longitudinal section of an infected grain, more advanced, being about eight or ten days after fecundation; at that period the ergot is considerably enlarged, and has already torn and detached from its base the integuments and cellular substance of the original germen.

After the ergot emerges from its husk, it enlarges very rapidly, and when the rye is ripe, the ergot is often five or six times the bulk of the sound grain (see Tab. XXXII. fig. 11); and considering that the ergot is only the enlarged scutellum, the natural size of which is not quite a tenth part of an inch, it must be confessed that the enlargement is prodigious; but not all the ergots even in the same ear attain the same size (see Tab. XXXII. fig. 10). The general number of ergots in an ear is from six to eight, but sometimes there are even more, and very often there is only one single ergot in an ear, the rest of its contents being fine sound grains; but in ears which contain many ergots the sound grains are generally small and stunted. As the substance of the ergot is very soft at its formation within the young germen, it generally retains some shape of the original grain, particularly the groove at the back.

After the ergot has emerged from the husk, its substance soon indurates, and assumes a dark brownish-purple colour, and gradually becomes very hard, and after having been in contact with the air and exposed to the sun for some time, the ergot, having no integument, cracks in many places; and I think it is such fissures which some authors consider to be perforations made by insects,—an opinion, however, which is totally unfounded, for there exist no perforations in the ergot at any period of its formation or vegetation. If cut through while yet in a green or fresh state, the internal substance of the ergot appears of the firmness of an almond or nut. If the ergot is soaked in water a month or longer, it gets soft, but never dissolves, and if bruised, the substance is found to consist of smaller particles than the albumen of the sound grain, and if examined through a microscope under water many large blotches of oil appear to be mixed with it, and when an ergot is lighted at one end, it burns with a bright flame like a wax candle; this is also the case with

the minute scutella of sound grains, the substance of which is precisely of the same nature.

From the facts above stated, I think no doubt can remain in the mind of any unprejudiced observer, that the ergot is solely a monstrosity or transformation of the embryo of the germens of the rye, and those gramineous plants which are subject to this disease. But what is the cause of this monstrosity or transformation? This is a question which I confess I cannot answer; but my attentive observations and continued researches on the subject of the diseases in corn have convinced me that rainy and wet seasons are not the cause; for during that period the various states of the weather had never produced a corresponding effect on the corn, for the disease was often more prevalent in a dry than in a wet season; neither can I agree with those who consider that insects cause it, for those minute flies and insects so often found in infected ears, are also found, not only in the soundest ears of rye and other gramineous plants, but are likewise found abundantly in all species of Syngenesious and other plants, where they seem to rummage the pollens of the anthers.

Whether some particular soil might cause this disease, I had no opportunity of ascertaining, because in the neighbourhood of Kew very little rye is cultivated; but it would be very interesting and desirable if some practical agriculturist would make the experiment on an extended scale, by sowing a certain quantity of sound rye seed-corn, from the same sample, on different soils, and attentively observing, at the proper season, on which soil the disease was more or less prevalent, and then analyse the component parts of the soil. Such experiments would undoubtedly lead to some satisfactory result.

The only experiment I was enabled to make, was collecting a small quantity of rye grains from ears which were strongly infected with ergots, and sowing these separately, but they did not produce one infected ear.

The cause of this disease being yet totally unknown, it would be presumptuous and idle to talk of remedies to prevent or cure it; that must be left till the real cause is discovered.

The pernicious quality of the ergot of rye, and the severe and often fatal diseases engendered by the careless admixture of that substance with sound corn, for human nourishment, has been recorded by many eminent authors.

Galen mentions fever, delirium, gangrenous ulcers, &c., occasioned by it: and Tessier gives the results of many experiments, which not only confirm what Galen said of the ill effects the ergot has upon the human frame, but he also ascertained that it produces the same ill effects upon the health of brutes, such as dogs, swine, and poultry,—which all instinctively refuse to eat the ergot of rye; but by disguising it, and by forcibly feeding them with it, he found the same injurious and frequently fatal effect was produced on these animals as that on the human species.

The discovery of the very beneficial and almost wonderful medicinal qualities of the ergot of rye is but of very recent date; Tessier, about 1783, says "It is asserted by some that it is successfully employed in hastening labour, and in pleurisy;" but, he observes, "those assertions are not authenticated; and even if they were true, they would not disprove the injurious qualities it has in other cases, and under other circumstances."

Dr. Stearns, of New York, seems to be the first who found the ergot of rye to be the most efficacious remedy in cases of protracted labour and excessive hæmorrhage; in such cases, about 1822, he employed it most successfully, and since that time it has been almost generally adopted in this country with equal success. The periodical publication, *The Lancet*, since 1828 to this time, records many most interesting and successful cases, reported by eminent and extensive practitioners, from which it appears, that the lives of many patients, whose cases had been considered hopeless, have been saved by the instantaneous effects of this substance.

The ergot of rye is now an article provided in every dispensary: and since its important and beneficial medicinal quality is ascertained, even if an efficient remedy for preventing this disease were known, it would not be advisable to extirpate it; and there is no doubt, that, when those valuable qualities of the ergot get generally known among the cultivators and farmers, and that a bushel of ergots will probably fetch more than four or five bushels of the finest rye, they will think it worth their while to collect, and carefully separate, the ergots from the corn; by so doing, they would not only be compensated for their trouble by the sale, but at the same time purify the corn, and thus prevent the pernicious effects of the ergot.

EXPLANATION OF TAB. XXXII.

Fig. 1. A front view of a sound germen of rye, about four days after fecundation: magnified eight times in diameter.

2. A side view of a longitudinal section of the above germen: magnified in the same degree.

3. A front view of a longitudinal section of the base of the above germen, or rather young grain, which shows the first beginning of the formation of the embryo: magnified sixteen times in diameter.

4. A front, and Fig. 5. a back view of an infected grain, from the same ear as Fig. 1., soon after fecundation, when the disease makes its first external appearance: magnified eight times in diameter.

6. A front view of a transverse section of the above infected grain, cut at letter A, Fig. 7.: magnified sixteen times in diameter.

7. A side view of a longitudinal section of the same infected grain: magnified eight times in diameter.

8. Front view of a section of the same infected grain, cut at letter B, Fig. 7.: magnified sixteen times in diameter.

9. A side view of a longitudinal section of an infected grain, about eight or ten days after fecundation; the young ergot is enlarging, and has already torn up the integument of the germen, and detached it from the base: magnified eight times in diameter.

10. A full-grown ear of rye, strongly infected with ergot: *natural size.*

11. A full-grown ergot, within its floret: magnified five times in diameter.

12. A transverse section of the same: magnified five times in diameter.

13. Albumen of a sound grain of rye: magnified two hundred times in diameter.

14. Internal substance of the ergot of rye: magnified two hundred times in diameter.

Observations.—Thus far I had carried my investigation and illustrations of that singular disease the Ergot in Rye, during the years from 1805 to 1809, and which illustrations have been for many years in the British Museum; and

though since that time some ergotized plants came occasionally into my hands, I never examined them with an intention to discover anything new in them, till in October 1838, when Mr. John Smith, the chief assistant in the Royal Botanic Garden at Kew, brought to me some specimens of ergotized plants of a species of *Elymus*, which were not only infected with ergot, but of which every external part was infected with a minute filamentous fungus, bearing an infinite number of sporidia, which I never before had observed.

Mr. Smith has given a very detailed and correct account of this fungus, in a paper which was read before the Linnean Society on the 6th of November, 1838. He also communicated his discovery soon after he showed it to me to his friend Mr. Quekett, who read on the 4th of December before the Linnean Society a long and very elaborate paper on the same subject, and in which he quotes some very interesting works by M. Leveillé, Dr. Phœbus, and Philippar, which, to judge from Mr. Quekett's quotations and copies of figures, seem to be very correct observations and illustrations of that subject; but these original works I have not yet seen, and from all these observations and illustrations I am not yet convinced that these filamentous fungi with numerous sporidia are the cause or the consequence of the ergot, because,

1st, Every gramineous plant is equally infected with that minute filamentous fungus, yet very few of these plants produce ergots; and amongst agricultural grains, the rye is the only one that is subject to that disease; among the many hundred ears of wheat that I examined in every stage of its growth, I found only one spikelet that produced three ergots, and one spikelet with only one ergot.

Because, 2nd, in autumn all decaying plants are infected with such filamentous fungi and minute sporidia; and Mr. Smith, when he brought to me the first specimen of his ergot, brought me also a specimen of a flower of *Canna indica*, in which not only the inside of the anther was infected with this filamentous fungus, but also the individual pollen grains were strongly infected with it.

For these reasons, I cannot yet consider the question, of the cause of the Ergot, as finally and satisfactorily settled; but I hope those naturalists who have already done so much on that subject will persevere in their researches and experiments till they finally succeed.

EXPLANATION OF TAB. XXXIII. A.

Fig. 1. A young ergot, with its anthers and bracteas, about ten days after fecundation: magnified ten times in diameter.

2. The same young ergot, with its anthers and bracteas removed: magnified ten times in diameter.

3. A millionth part of a superficial square inch, filled with the sporidia, which appear on the external surface of the ergot of *Elymus*, as well as on those of ergot of rye, and which appear on every part of these plants, and ultimately are washed off by the dew or rain, and mixed with the water: magnified a thousand diameters.

4. A portion of an anther, bearing the same filamentous fungus.

5. A group of the filamentous and articulated fungus which infests every part of the plants of *Elymus*, and almost every gramineous plant, whether infected with ergot or not: magnified a thousand times in diameter.

6. A millionth part of a square inch, filled with the sporidia of the external surface of the red or orange-coloured ergot: magnified a thousand diameters.

Francis Bauer.

Kew Green, December 14th, 1839.

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Mr. Griffith is desirous that it should be stated, that the insects collected by him in Assam, and described by Mr. Hope, formed no part of the Government Collections, but were collected during the time when he was not attached to the Deputation.

VOLUME XVIII.

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Read March 19th, 1839.

FROM various causes, particularly removing from North Wales to this place, I have not had it in my power at an earlier period to reduce my observations into proper form for your perusal. A visit to St. David's would amply repay a botanist, as, from what I saw, I conceive it to be a rich locality, and, as far as I know, not yet explored; but having on the second day of my arrival gathered *Pilularia globulifera* for the first time in my life, I determined to bestow all the time I could command on its examination, and therefore I did not collect many species. I must beg to remark, that as I only know what preceding observers have discovered of the structure of *Pilularia* through Lindley's Introduction to the Natural System, and Hooker's British Flora, it is possible that the greater part of my observations may be already known; and therefore I leave you to judge whether this letter contains sufficient novelty to justify its publication.

The involucrum (Tab. XXXIV. fig. 2.) of *Pilularia globulifera* contains two kinds of bodies, which, however, occupy distinct sacs: one kind (Tab. XXXV. fig. 36.) are round, very numerous, and minute, not larger than the 460th part of an inch; they are found principally in the upper part of the involucrum, and are about forty in each sac: the other kind (Tab. XXXIV. fig. 3.) are of an oblong pyriform shape, a little constricted near the middle, with a conical projection at one extremity, and are much less numerous, about sixty, and occur singly in each sac; they are about the 80th of an inch broad, and have the power of germination, which the former kind do not appear to possess. Both kinds are loose in their sacs, and have an opake, pure white, minutely granular, testaceous covering, and are imbedded in a kind of gelatine, which

softens and expands by the action of water, but is not completely dissolved. The larger bodies, the undoubted sporules, after a very slight maceration in water—less than a minute is sufficient—are enveloped by a well-defined covering of gelatinous matter, which before the maceration existed in a concrete state (TAB. XXXIV. fig. 3.). Further maceration does not appear to affect this gelatinous covering, as it remains unchanged long after germination, and gives to the sporule the appearance of having a very delicate transparent border, whose breadth is about the fourth part of the diameter of the sporule. The sporule consists of three coats, the outer of which is white, opake, somewhat brittle, more or less incomplete at the conical extremity, but much thickened about the upper third of the sporule, where it exhibits traces of cellularity. The middle coat is membranous, elastic, of a light yellowish-brown colour, and perforated at the apex of the conical projection (TAB. XXXIV. fig. 5.), which is essentially formed by this coat, the outer coat being gradually lost upon its surface, or in some instances being scarcely continued on to it; in which case the sporule appears truncated, the middle membrane not having sufficient firmness of itself to support the conical form (TAB. XXXIV. fig. 4&5.). This conical projection is more or less plicated; and in those instances in which the outer coat is very deficient, the middle membrane exhibits lines radiating from the aperture. The third coat or internal membrane is similar in colour to the middle, differing from it, however, in being inelastic and not being continued into the cone, but forming a short cavity by passing directly across the base of the cone, at which point it is not in contact with either of the other membranes, and is marked by three lines, which radiate from the centre of the unsupported portion, and indicate a valvular structure to allow of the protrusion of the growing matter in germination (TAB. XXXIV. fig. 6, 8, 9, & 11.). [The cavity of the sporule is occupied by a quantity of grumous fluid and particles which are of various sizes, the larger ones being mostly of an ovoid shape, but altering by pressure (TAB. XXXIV. fig. 6 & 7.).]

I found many of these sporules in a germinating state, the majority having escaped from the involucrum; but in several instances I found them considerably advanced in germination before the rupture of the involucrum and whilst they were yet inclosed in their sacs. The first external sign of germination is either the appearance of four cells projecting through the apex of the conical

projection, or a general swelling of that part (Tab. XXXIV. fig. 12.). By dissection, however, we can observe this process at an earlier period; and I find, upon removing the conical projection, that the first evidence of germination having commenced is an appearance of cellularity within the unsupported or valved portion of the internal membrane, which is transparent; and I now find, for the first time, a very delicate pellucid membrane lining the whole cavity of the sporule, and having the cells, which give the appearance just mentioned, either lying on its external surface, or forming that portion of it which lies beneath the valves. From the appearances, and the impossibility of separating the cells from the membrane, I am inclined to believe that the cavity formed by this membrane is completed by the cells, or, in other words, that the sac is partly membranous and partly cellular (Tab. XXXIV. fig. 10 & 11.). It is possible that this last-described membrane may exist before germination begins, notwithstanding the numerous unsuccessful dissections which I have made to discover it, the failure being owing to its extreme delicacy; but I am pretty well satisfied that it is a product of germination, because I have not the slightest difficulty in demonstrating it after that has commenced, nor is there the slightest trace of it in any stage of the development of the sporule. However this may be, it is quite certain that fresh cells are gradually formed on the external surface of the cellular part of the sac, and that the valves of the third membrane are very soon ruptured and gradually turned back by the growth and protrusion of this button-like cellular germ (Tab. XXXIV. fig. 9 & 13.). The enlarging cellular mass then distends the conical projection, unfolding the plicæ of that body, and at length appears externally with four of its cells projecting beyond the general mass, and compressed into a quadrangular form by the pressure, as I imagine, of the apex of the cone, the aperture in which is quadrangular. These projecting cells soon harden, and acquire a reddish-brown hue, and in the advanced stage of germination appear like a brown quadrangular space, which I should have little hesitation in referring to the above cause, did I not find several similar spaces on the germinating sporules of *Isoëtes lacustris*, which I could not refer to such an origin: it must be observed, however, that I have not seen the earlier stages of germination in *Isoëtes*. Soon after the exposure of the entire germ, which is effected by the reflection of the valves and conical membrane over the side

of the sporule, where they lie quite concealed by the germ, little fibrillæ or rootlets begin to shoot from one side. They are simply articulated tubes, or elongated cells applied end to end, with frequently a bulbous extremity; and each is produced from one of the cells of the germ (Tab. XXXIV. fig. 14.). They differ much in length in different sporules; in some they are not longer than the sporule, whilst in others they are three or four times that length, and, in common with the cells of the germ, contain granules, which in these are colourless, but in the germ green. The cluster-like appearance of the cells which form the germ soon after the appearance of these fibrillæ, begins to change, the cells becoming flatter and more intimately connected with each other. At the same time an internal change is taking place, for by a gradual arching or receding upwards of that part of the germ which closes the cavity of the sporule the germ becomes hollow, the hollow communicating with the cavity of the sporule, which is of course proportionably enlarged (Tab. XXXIV. fig. 16.). The germ now gradually points in two places, which are by no means fixed, but occur in various situations according to the position of the sporule in relation to the light. The direction of the first leaf is generally in the direction of the axis of the sporule, or rather a little inclined; and that of the first root at right angles, or lateral, but very soon changing to an opposite direction to that of the leaf. This would be the constant direction if the sporules were always left to themselves, free from entanglements, on account of the peculiar structure of their outer coats, the spongy fibro-cellular texture of the superior third of which, causing that end to be the most buoyant in the water, exposes the superior surface of the germ to the direct action of the light; but as it cannot always happen that the sporules should be free, the direction of the leaf and root is sometimes quite the reverse, and at others both leaf and root are lateral, but proceeding from opposite sides of the germ. These two points gradually lengthen, and, if dissected, each will be found to consist of a closed sheath, containing in one instance the leaf, in the other the root, in the form of a conical process like a finger in a glove. The young leaf, which is taper, and has its cells crowded with green granules, being in advance of the root, which is obtuse and destitute of green granules, bursts through the summit of its sheath when it has become rather longer than the sporule; whilst the root, although more backward in its development, pierces its sheath before it becomes as

long as the sporule (Tab. XXXIV. fig. 18.). The sheaths are not distinct, but communicate with each other; and the only point of connexion between the sheath (there being in fact but one) and the germ is around its base close to the sporule, so that nearly the whole of the germ is inclosed in this sheath (Tab. XXXIV. fig. 19, *b*.). Besides this sheath, which embraces the upper part of the root, there is an exceedingly delicate expansion which so closely embraces the extremity of the root like a cap, that it is only by a careful examination that it can be discovered (Tab. XXXIV. fig. 18, *a*.). I am not aware that this has ever had any connexion with the sheath through which the root bursts, but, on the contrary, I believe it to be a distinct formation. After the leaf has grown to be many times the length of the sporule, or about two lines long, another leaf grows from the germ close to the first, to which it is in all respects similar; and then a bud begins to be developed from some indefinite part of the germ, but like the leaves and root, from within the sheath, which is now frequently much lacerated (Tab. XXXIV. fig. 19.). This bud is covered by a peculiar kind of jointed hairs, whose attachments are lateral at a short distance from their bases, and which contain a few colourless granules (Tab. XXXIV. fig. 19.). This bud sometimes appears after the first leaf, in which case there is no second primordial leaf formed; and is the rudimentary stem, the first growth from it being a leaf, which exhibits, although in a small degree, the first evidence of gyration, and shortly after a root, which is furnished with its own sheath. As I have not seen more advanced specimens, I am unable to describe the succeeding steps; but as, up to this point, my observations were made upon several hundred examples, I may safely affirm that the instances were sufficiently numerous for my purpose.

All the leaves after the primordial ones, or those which grow directly from the germ, are developed in a similar manner to those of Ferns, and even the running stem partakes in a slight degree of the same gyrate evolution (Tab. XXXV. fig. 20.). The roots are all formed in sheaths, through the apices of which they ultimately burst, the sheath continuing to embrace the base of the root, whilst a distinct and far more delicate sheath closely embraces its point (Tab. XXXV. fig. 20, *b*.). Transverse sections of the stem, root and leaves show them all to be hollow, with the cavity divided longitudinally into separate channels. In the stem these longitudinal partitions are about fifteen or

sixteen in number, and in the leaf (Tab. XXXV. fig. 24.) and root they are about ten or twelve; in the latter they are arranged in pairs (Tab. XXXV. fig. 25.). These partitions radiate from a central column of enlarged cells which surround a bundle of minutely dotted ducts, that may be unrolled spirally (Tab. XXXV. fig. 27.), and the channels between these partitions are frequently divided by transverse partitions or diaphragms. The cells which form these partitions are curiously arranged (Tab. XXXV. fig. 27 & 28.); they are flattened on two opposite sides, and connected with each other by their narrow sides and extremities, but only at intervals, so that there are numerous holes formed which afford a free communication between all the channels. In the partitions of the root, the intervening holes are so large in proportion to the breadth of the cells, that these have the appearance of a string of beads (Tab. XXXV. fig. 28.). Another peculiarity of the root is, that, in addition to the diaphragms formed of this tissue, which are also found in the stem and leaf, a peculiar body is frequently met with, occupying a similar position to the diaphragms (Tab. XXXV. fig. 25.). These bodies (for they are sometimes numerous) are each formed of one or more cylindrical cells coiled up in a gyrate manner. They grow from the angle formed by the partition and the cuticle, and are developed subsequent to the other tissue, for they may be found in various stages of advancement in the same root. Their nature I have not been able to ascertain.

I shall now proceed to describe the development of the sporules. A transverse section of the involucrum, when about the size of a small pin's head, shows it to consist of four integuments containing a mass of very delicate, spongy, compressible cellular tissue, subdivided into four equal triangular portions by four lines radiating from the centre. In the centre of each of these portions is a cavity, and projecting into each of these cavities are a number of nipple-like processes, which are attached in each cavity to a common receptacle, whilst this, again, is connected with an open, rigid, cellular tissue, that lies between the spongy tissue, before described, and the involucrum, and serves as a connexion between the two (Tab. XXXV. fig. 29.). As the involucrum advances, the spongy tissue recedes all round the four cavities, which consequently become larger, and afford more space for the growth of the nipple-like processes. This recession of the spongy tissue is not caused by the pressure

of the growing processes, for it is frequently in advance of them; but it is produced by a gradual condensation, inherent to the tissue, around the cavities and along the radiating dividing lines, which, in fact, are nothing more than the result of this condensation, which at maturity is so complete, that the whole of the spongy tissue is condensed into four dissepiments, dividing the cavity of the involucrum into four equal loculi (Tab. XXXV. fig. 30.). The nipple-like processes are found upon a careful examination to be hollow sacs with obscurely cellular walls, those which occupy the lowest part of the involucrum being considerably in advance of the upper ones. These sacs contain a quantity of grumous matter, and a number—perhaps about ten—of soft, rather opake pulpy bodies, which are evidently compounded of four closely connected parts, so placed on each other as to form a cone with a triangular base (Tab. XXXV. fig. 31 & 32.). These bodies have their future development in two different ways, according, in a great measure, to the position they occupy in the involucrum. Those which occupy the upper portion, although not absolutely confined to that portion, enlarge, become pellucid, and recede from each other, but continue to be attached to each other by four stalks as long as half their diameter, which meet in one centre (Tab. XXXV. fig. 33.). It is now evident that these four bodies or sporules are contained in a mother-cell, which most probably existed before, but on account of its close approximation to the four united sporules could not be seen. On the surfaces of each of these sporules are three short lines which radiate from the insertion of the stalk. From an observation of the sporules of *Isoëtes lacustris*, I am inclined to believe that these lines are a slight ridge caused by the projection of the membrane into the interstices between the three other sporules, and that the stalk is a drawing-out, as it were, of the same membrane, some evidence of which is seen in the instance represented at Tab. XXXV. fig. 34. At length the mother-cell is ruptured, and the sporules separate from each other at the point where the stalks meet in one centre, so that each sporule is furnished with a short tail, which, however, soon disappears (Tab. XXXV. fig. 34.). A deposit gradually takes place on the outer surface of the sporule, forming a second coat, which gradually becomes more and more opake, until the three radiating lines are quite invisible, and the sporule a perfectly opake white body (Tab. XXXV. fig. 35 & 36.). Until the sporules have become opake they are quite empty,

but at last they contain a little grumous matter. What becomes of the mother-cell I am unable to say: I am inclined to think that a portion of it becomes attached to the surface of each of the sporules, of which there are about forty in each sac.

The other bodies, or rather those which occupy the sacs at the lower part of the involucrum,—for there is no difference between the two at the earliest stage, except in position,—should have been described first, on account of their being somewhat more advanced in point of development; but as the changes are rather more complex than those just described, I prefer taking them in this order. The sporules (TAB. XXXV. fig. 31 & 32.) first enlarge, become pellucid, and recede from each other just as the last-described (TAB. XXXV. fig. 33.), but they do not appear to remain long in this stage, as it is very difficult to obtain them until nearly all the sporules have been ruptured from some unknown cause (TAB. XXXV. fig. 38.). The shrivelled remains of the ruptured sporules continue to be attached to each other by their stalks, and the mother-cell remains perfect; in short, no further change takes place, for they may be found in this state in the same sac with the ripe sporules (TAB. XXXV. fig. 42, *a*.). The two or three unruptured sporules, which are single in each union, the other three being invariably ruptured (TAB. XXXV. fig. 37.), enlarge, each struggling for the mastery, and it is not long before one prevails, the smaller ones rupturing and passing into the same state as those first ruptured (TAB. XXXV. fig. 38.). The sole remaining sporule now enlarges rapidly, assumes a pyriform shape, and the mother-cell gradually recedes from it by a still more rapid enlargement, except around the narrow extremity to which the three ruptured sporules which form the union are attached, where the mother-cell has contracted an adhesion. It appears that this dilatation of the mother-cell is caused by a secretion of fluid between it and the sporule, for if the cell be punctured the fluid will escape, and the cell return by its elasticity to the same dimensions as the sporule. The three ruptured sporules, which up to this period remained attached to the growing sporule, now disappear, and, as I have not been able to make an exact observation as to the manner of their disappearance, I cannot say positively whether they have been absorbed or discharged through a rupture of the mother-cell. That this last supposition is the correct one, I think may be inferred from the

facts, that the other ruptured sporules are not absorbed, and that an aperture in the mother-cell does actually exist at the proper place, but on account of the delicacy of the object it cannot be clearly ascertained until a later period (Tab. XXXIV. fig. 5.). The sporule now begins to assume a yellowish-brown hue, and a deposition of opake matter takes place on the outer surface of the mother-cell around the smaller extremity (Tab. XXXV. fig. 40 & 41.). This deposition gradually increases until the whole sporule is completely covered, except in some occasional instances the apex of the conical projection formed by the mother-cell remains uncovered (Tab. XXXIV. fig. 4 & 5.). This deposition, which forms the outer coat of the sporule, is much thicker about the smaller extremity of the sporule than elsewhere, and acquires at this part a fibro-cellular texture, as represented at Tab. XXXIV. fig. 6. When the outer coat is completely formed, the mother-cell or middle coat ceases to enlarge, whilst the inner sac or true sporule continues its growth until it is checked by coming in contact with the inner surface of the mother-cell, to which in its mature state it is firmly adherent. The sporule is at first perfectly pellucid and deficient of all granular contents; it is not till after the addition of the outer coat that the grumous granular matter is secreted. It will be seen from this description, that the anatomy of the ripe sporule accords with what is observed to take place during its development; and as the dissection of the ripe sporule occurred first in the order of my observations, this correspondence was a source of great satisfaction to me. It appears, therefore, to be certain that the sporule consists, in the first place, of the internal membrane or coat formed by the true sporule, then the middle coat formed by the mother-cell, and lastly, the outer testaceous opake coat, the result of the deposition, to which some may perhaps be inclined to add the gelatinous covering which makes its appearance on maceration in water; but as it is not an organized substance, I am not disposed to consider it as a proper integument. As there is no evidence whatever, during the development of the sporule, of the internal delicate sac which is found after germination has commenced, I think we may safely conclude that it is the product of germination. It is scarcely necessary to remark, that the first-described bodies are those which have been considered by some botanists as the pollen, or that Dr. Lindley's shrewd conjecture, that they are abortive sporules, is perfectly correct. In

connexion with this subject I shall take the opportunity of observing, that from a partial examination of *Lycopodium* and *Isoëtes*, I believe Dr. Lindley is also correct as to the pulverulent matter of those genera being abortive sporules. I at first intended to add to this paper some general observations on the several groups which compose the *Cryptogamia* of Linnæus, but I now think it more desirable to defer this until they have been separately submitted to examination; for without an accurate knowledge of their structure and germination, it is impossible to arrive at a satisfactory conclusion as to their affinities. I cannot help observing, however, that Dr. Lindley has not in my opinion exercised his usual judgment in removing *Equisetaceæ* from *Acrogens* to *Gymnosperms*. The affinity which they have to the latter is entirely in their aspect; there is no obvious structural or physiological analogy between them. The supposition of Brongniart, that the reproductive body is a naked ovule, and the four filaments that surround it four grains of pollen, without the power, according to Lindley, of performing their function, is contradictory; for what evidence have we of any fertile ovule without the agency of the male organ? Besides, this supposed ovule is admitted in the same paragraph to be a sporule, and afterwards proved to be such by its germination.

This account of *Pilularia* shows that it is incorrect to say of *Acrogens* that "germination takes place at no fixed point, but upon any part of the surface of the spores;" for it is quite certain in this instance that germination invariably takes place at a fixed spot, which may be pointed out before germination has commenced. It is at that part of the sporule indicated by the three radiating lines which appear to have been produced by the pressure of the three other sporules that originally helped to constitute the quaternary union; and as the spores of all the other tribes appear, according to Mohl, to be developed in similar unions, it is most probable that similar lines indicating a valvular dehiscence also exist on them. This is certainly the case in some Mosses, for instance, in *Œdipodium*, and in *Isoëtes*, *Lycopodium*, and *Osmunda regalis*; and in those instances where such a structure is not visible, it is probably owing to a thickening of the membrane, or a deposition of opake matter on its surface, as in *Pilularia*. In the mature sporules of *Pilularia* they can only be discovered by dissection, and in the abortive ones they cannot be discovered at all after the first stages of their growth; whilst, again,

the sporules of *Jungermannia complanata* exhibit similar lines after they have been submitted to the action of sulphuric acid. After the protrusion of the germ, however, it does appear to be quite immaterial from what part of the germ the first leaves, root or stem shall arise.

It is almost superfluous to point out, that these primordial leaves, if the sporules be considered as seeds, have no analogy, except in their use, with cotyledons, because true cotyledons pre-exist in the seed, whereas these are the product of germination. But according to the view of the nature of sporules which I have endeavoured to establish, *Pilularia* must be considered as nearly allied to monocotyledons in its germination. In cotyledonous plants the first steps of germination (under which term I include the growth of the mature pollen) are protected by a distinct apparatus (the seed-coats) furnished for that purpose; and in monocotyledonous plants a single primordial leaf and root are developed in a sheath, through which they burst in the progress of germination. Now *Pilularia* differs from this simply in not having the first stages of its germination protected by a separate apparatus, unless, indeed, the conical membranes which form the external cavity (Tab. XXXIV. fig. 6.) at the germinating end of the sporule are to be considered as the most rudimentary state of the female organ; for, as in monocotyledons, the cellular mass arranges itself into a sheath, which incloses the rudiment of a leaf and root, and the amylaceous (?) particles and grumous fluid, which fill the cavity of the sporule, fulfil the same office as the albumen of monocotyledons. I shall conclude these observations by stating that I have not been able to detect any organs which, as in the Mosses, can by any possibility be supposed to perform the office of impregnating the sporules.

Tintinhull, near Ilchester,
Feb. 18, 1839.

EXPLANATION OF THE PLATES.

Tab. XXXIV.

Fig. 1. A plant of *Pilularia globulifera*, of the natural size.

Fig. 2. A mature involucrum, of the natural size, and in a dehiscent state.

Fig. 3. A fertile sporule, with its gelatinous covering: this and all the subsequent figures are highly magnified.

Fig. 4. Upper portion of a sporule, in which the outer membrane is deficient on the conical projection, in consequence of which the more delicate middle membrane is collapsed, and gives a truncated appearance to the sporule.

Fig. 5. A perpendicular view of this truncated conical projection. *a*. The short outer membrane. *b*. The middle membrane, with an aperture and several lines on its surface.

Fig. 6. A section of a sporule, showing an outer coat, which is much thickened and of a cellular appearance, at the upper part of the sporule, and may be traced on to the conical projection; a middle membrane, which may also be traced into the conical projection; and the third or internal coat, which does not assist in forming the conical projection, but, passing transversely across its base, forms a short cavity. The granular contents are also shown *in situ*.

Fig. 7. A few of the granular contents of various sizes; they refract the transmitted light to the centre.

Fig. 8. A perpendicular view of a sporule, the conical projection being removed to show the transverse portion of the internal coat. The three radiating lines indicate a valvular structure.

Fig. 9. A similar view of a germinating sporule. The germ has ruptured the valves.

Fig. 10. The germ separated, to show its attachment to a delicate membrane which lines the whole cavity of the sporule.

Fig. 11. Section of the upper part of a germinating sporule, showing the germ before the rupture of the valves. It will be now seen, that there is an additional membrane to the sporule with which the germ is continuous.

Fig. 12. View of the upper part of a germinating sporule, which is more advanced; the conical projection is dilated by the pressure of the growing germ, four of the cells of which are visible externally.

Fig. 13. View of a germinating sporule, not quite so far advanced as the preceding. The conical projection has been removed to show

the germ, which has pushed through the valves. *a*. One of the valves.

Fig. 14. A more advanced sporule. The mass of cells which constitute the germ has here forced its way through the conical projection, which is partly dilated and partly ruptured, and lies concealed between the germ and the sporule. A few of the cells of the germ have thrown out rootlets.

Fig. 15. In this stage the cells of the germ have assumed a more membranous character and a more defined shape; it will, in fact, be found to contain the rudiments of a root and leaf. *a*. Four cells, which form the quadrangular space mentioned in the description, and probably similar to the four projecting cells seen in fig. 12. The rootlets are more numerous.

Fig. 16. A section of the last sporule in outline. *a a*. The outer coat. *b*. The conical projection concealed by the germ. *c*. One of the valves. *d d*. The outer cells of the germ, separated from the central mass to form a sheath for the leaf and root. *e e*. The place where the sheath and central portion of the germ remain continuous. *f*. The arching upwards of the germ by which the cavity of the sporule is enlarged. *g*. The young leaf. *h*. The young root. *i*. The first appearance of vessels. As the germ grows, these vessels are prolonged into the leaf and root.

Fig. 17. A more advanced germ; the leaf and root are still inclosed in their sheath.

Fig. 18. The leaf and root have at length burst through the sheath. *a*. The sheath at the tip of the root.

Fig. 19. In this specimen there are two leaves: the sheath has been opened to show the bud and the connexion of the parts. *a a a*. The cut edge of the sheath. *b*. The sheath cut close to its connexion with the body of the germ. The germ is hollow as high up as the base of the bud. The bud consists of a point, from which the first leaf, having a tendency to gyration and a root, are in progress of development, concealed by a quantity of hairs.

Tab. XXXV.

Fig. 20. The termination of a growing branch, with two young leaves and four roots in various stages of advancement. *a.* Is a root before it has burst through its sheath. *b.* The sheath which envelopes the tip of the root. *c.* A young bud, from which may be produced either a branch and leaves and roots, or an involucrum: it is impossible to distinguish one bud from the other in the youngest state. All the buds and growing extremities of the branches are clothed with hairs, which fall off as the part becomes developed.

Fig. 21. An involucrum about half matured; it is densely covered with hairs, which gradually decay and fall off, so that there are only a few decayed remnants left on the mature involucrum.

Fig. 22. A hair from an involucrum. *a.* The point of attachment.

Fig. 23. A hair from a bud. *a.* The point of attachment.

Fig. 24. Section of a leaf, showing the central bundle of vessels surrounded by enlarged cells; the partitions, and a diaphragm.

Fig. 25. Section of a root, showing two of the gyrate bodies, which are frequently found in the cavities of the root.

Fig. 26. A portion of the cuticle of the leaf with stomata.

Fig. 27. Longitudinal section of a leaf, giving a view of a partition, and the central bundle of spiral vessels.

Fig. 28. A portion of the tissue which forms the partition in the root.

Fig. 29. Section of a young involucrum. In this stage the three outer coats are of a very faint brown colour, and the inner quite colourless. The two middle coats are drawn scarcely thick enough. The thecæ contain sporules in the first and second stage of development; they are too opake, however, to show their contents with any distinctness.

Fig. 30. Section of a mature involucrum from about the middle, so that it contains both kinds of thecæ; those containing fertile sporules, and those which are occupied by the abortive ones.

Fig. 31. A union of sporules in their first stage; the mother-cell is not visible in this stage:—magnified 200 times.

Fig. 32. Another view of a union of sporules in their first stage.

Fig. 33. A union in its second stage; the mother-cell is now visible:—magnified 150 times.

Fig. 34. An abortive sporule in the third stage:—magnified 120 times.

Fig. 35. An abortive sporule after it has acquired its outer coat, but before the coat has become thick enough to obscure the lines on the sporule.

Fig. 36. An abortive sporule in its final shape.

Fig. 37. Fertile sporule in the third stage. Three of the sporules are ruptured; the other is enlarged:—magnified rather more than 100 times.

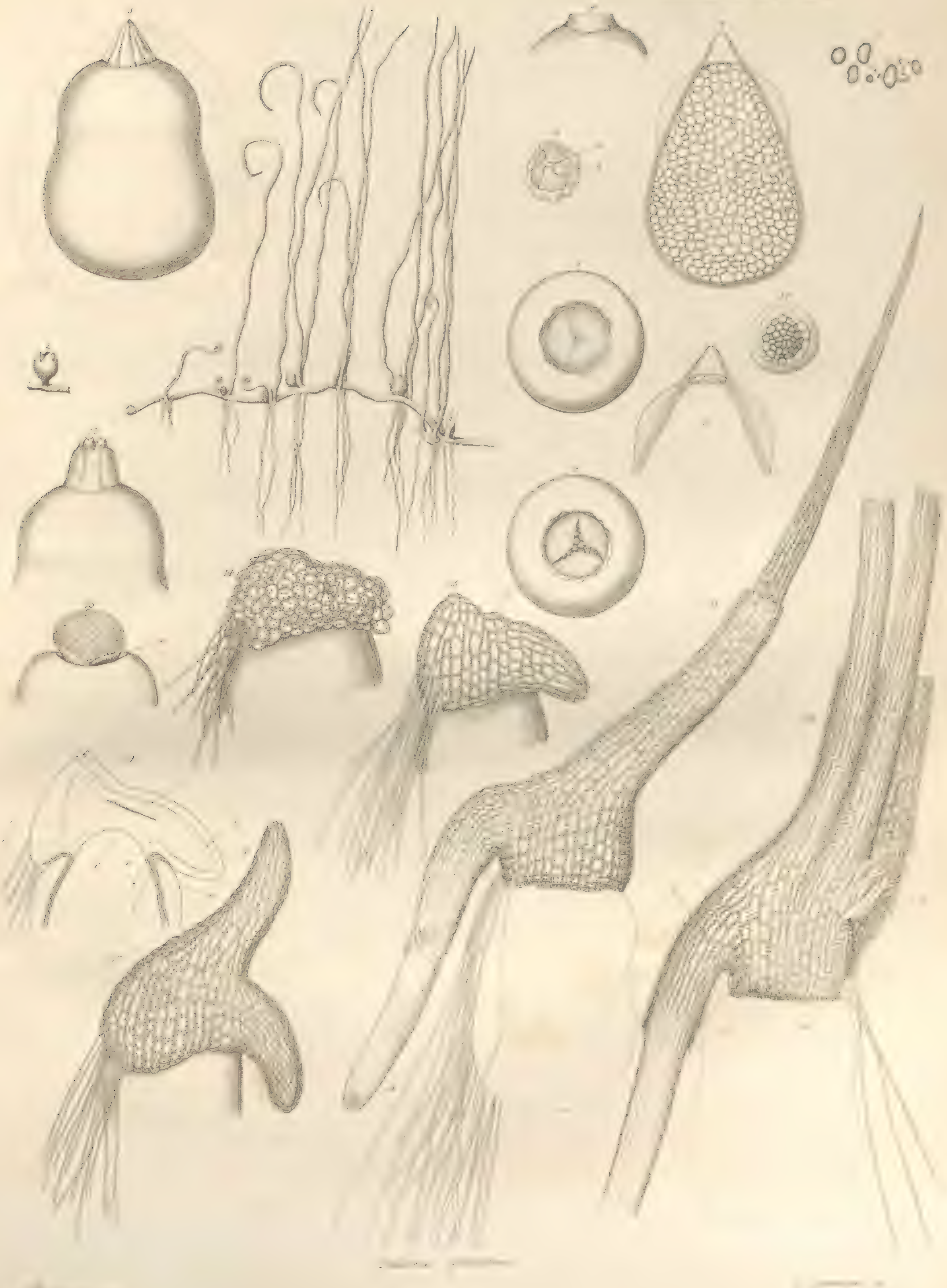
Fig. 38. A union of sporules from a fertile theca, in which all four of the sporules are ruptured.

Fig. 39. Is the same as fig. 37, but more advanced; the sporule is considerably enlarged and of a pyriform shape; the mother-cell is considerably dilated.

Fig. 40. A more advanced sporule. There is a considerable deposition of matter around the upper part of the sporule, and also a beginning at the larger extremity. The three ruptured sporules have disappeared:—magnified 54 times.

Fig. 41. A still more mature sporule.

Fig. 42. A ripe sporule in its theca removed from the involucrum. The action of the water in which it was examined on the gelatinous covering, and its being removed from the pressure of the other thecæ, have caused the theca to swell and assume a roundish figure. *a.* One of the four visible unions of ruptured sporules.



XXXI. *Supplementary Observations on the Development of the Theca, and on the Sexes of Mosses. In a Letter to* R. H. Solly, *Esq., F.R.S. & L.S.* *By* William Valentine, *Esq., F.L.S.*

Read May 7th, 1839.

I FIND, upon resuming the examination of Mosses, which I had given up, that I have not done Mohl justice in the note attached to my paper "on the Development of the Theca and on the Sexes of Mosses," published in the preceding volume of the Society's Transactions. In that note I have stated, that I thought Mohl was mistaken where he describes the sporules as being developed by fours in a mother-cell, believing that he had taken the several masses of granular contents, which may be in many instances observed in a sporule, as so many distinct sporules. I am now bound to confirm the accuracy of Mohl's observation in this respect; and I beg, through you, to offer to the notice of the Society a remarkable instance of the tetrahedral union of the sporules as an appendix to my former paper. The subject of the following account is *Œdipodium Griffithianum,* which, from my residence being near Snowdon, where it is found plentifully, I was enabled to examine in a recent state.

A transverse section of a very young theca (Tab. XXXV. fig. 9.) shows several concentric layers of cells in strict contact with each other. The outer layer is slightly tinged with brown, and is the true theca: the two next, the outer of which is pellucid, and the inner tinged with green granules, constitute the thecal membrane. The succeeding layer of cells also contains green granules, and the next is pellucid; these two form the sporular membrane. Independent of the number and sequence of the layers, by which we may decide in this state of the theca which will ultimately form the distinct sporular and thecal membranes, the presence of the green granules sufficiently identifies them; for if we examine a longitudinal section of a ripe

theca (TAB. XXXV. fig. 8.), we shall find that the space between the thecal and sporular membranes communicates with the loose tissue in connexion with the stomata, so that the air has free access to the opposing surfaces of those membranes; and it is a fact, that all the tissue thus exposed to the action of the atmosphere contains green granules, whilst in those parts of the tissue, the columella for instance, which may be supposed to be inaccessible to the air, the granules are smaller and colourless*. The proof is then satisfactory, that the last-described layer is the outer surface of the sporular membrane, which consists of certainly not more than two layers of cells; for I am confident, from the great number of species which I have examined in all stages of their growth, that this thickness of the sporular membrane is never exceeded. I have, in many species, had a difficulty in deciding whether there were more than one layer, but never that there were not more than two. It follows, then, that the next layer, after counting two for the sporular membrane, will either be the columella or a tissue occupying the sporular cavity. That this last is the truth, is proved by the fact of the succeeding layer being composed of decided sporules. The cells forming the layer which intervenes between the sporules and the sporular membrane are tinged with yellow, in which respect they resemble the sporules before they have arrived at maturity; and between the columella, which is composed of colourless cellules, and the layer of sporules, are two rows of cells, also coloured yellow similar to the last, and also occupying the sporular cavity. In this stage the sporules already formed consist of a disjointed cell containing a quantity of grumous granular matter. In some of the cells the grains are uniformly scattered, and in others they begin to arrange themselves in groups around four grains of larger development (TAB. XXXV. fig. 10.), which ultimately become four distinct sporules contained in a mother-cell. It is perfectly certain that the single row of sporules which exists in this stage is not equivalent to the thousands of sporules which exist at the time of maturity, and it therefore follows that more must be formed. Now as it has been already proved that the yellow cellules occupy the sporular cavity, and as they are exactly similar

* This remark, that the columella does not contain green granules, must not be understood as generally applicable, for there are many species in which the columella is crowded with green granules.

to the mother-cells, except that they are more adherent to each other, it is fair to presume that it is by a secretion of granules in their cavities that the additional sporules are formed. I have not been able to find a theca in an intermediate state between the formation of the first layer of sporules and the complete conversion of the yellow tissue into sporules. I am not at all certain by what means the four masses of granules in each mother-cell acquire each a separate envelope. It is certain, however, that they gradually become more and more distinct, and their enveloping membrane becomes more opake by a gradual deposition of a granular matter on its surface, which at maturity is completely covered. This granular deposit has but a loose connexion with the membrane, and is easily rubbed off in little grains, which are of a brownish colour when mature, and are individually transparent, although when crowded over the surface of the sporule they obscure its contents. The contents of the sporules gradually become less and less granular, the smaller grains being apparently absorbed by the larger one, which at length fills the entire cavity of the sporule*.

The four sporules in each mother-cell are piled on each other, so as to form a cone with a triangular base (Tab. XXXV. fig. 12.), and they appear to be connected with each other in the young state by a very minute stalk which is situated at the conjunction of three radiating lines (Tab. XXXV. fig. 13, 15

* I have described the contents of the sporules as they appeared at the time; it did not occur to me, until I had no longer the power of applying it to this species, that sulphuric acid might perhaps have some effect on the sporules of Mosses. From its effects on *Gymnostomum truncatulum* and several other species, I am now certain that these large apparent granules are globules of fluid surrounded by a thicker grumous viscid fluid, or I believe I may say, in other words, that they are particles of that fluid separated from its more solid constituents, which separation takes place gradually; and the globules thus formed, as they increase in size, combine with each other until there is but one large globule remaining, which occupies the entire cavity of the sporule, and is surrounded by the viscid matter of the fluid, which is consolidated into a most delicate translucent pellicle, that forms an elastic internal lining to the sporule. In the cavity thus formed is finally secreted the slimy granular matter, which in *Gymnostomum truncatulum* consists of a few granules only; in *Tortula ruralis* var. *lævipila*, the granules and globules of fluid are in about equal proportion; in *Orthotrichum striatum* the granules predominate; and in *Jungermannia complanata* I cannot discover any traces of fluid, the cavity being filled with granular matter. This fluid is easily observed on account of its immiscibility with water or sulphuric acid. This account of what I conceive to be the *modus operandi* is of course quite hypothetical.

& 18.). This connexion is, perhaps, in most instances dissolved at an early period, and the sporules recede a little from each other, but are still kept in the triangular form by the mother-cell (TAB. XXXV. fig. 13.). It is not uncommon, however, to find the connexion unbroken after the sporules have arrived at maturity; and in these instances there seems to be a general adhesion at the opposing faces of the sporules (TAB. XXXV. fig. 17.). When these adhesions are broken by violence, the adherent surface of the sporule is seen to be transparent, and altogether deficient of the granular deposit which covers the rest of the sporule, and the three radiating lines are most easily seen in this state of the sporule (TAB. XXXV. fig. 18.). The mother-cell remains entire until the sporules have nearly arrived at maturity, but as to what finally becomes of it I have no evidence. When it is ruptured by external violence it assumes a shrivelled appearance, as if it had been on the stretch and had contracted on the removal of the distention (TAB. XXXV. fig. 15.). I have observed several instances in which the mother-cell contained but one sporule, which was in all the cases round, and did not exhibit any signs of a stalk or of radiating lines on its surface (TAB. XXXV. fig. 16.).

I shall conclude this paper with some observations on the analogy that exists between sporules and pollen, which is so remarkable, and the particulars so numerous, that the essential identity of the two can, as I conceive, be scarcely a matter of opinion. In the first place, the sporules are formed in thecæ which have a great resemblance to some anthers. They are in most instances surrounded by a perichætium, which is a collection of modified leaves analogous to the perianth. They are either sessile, or seated on a stalk or seta, which may be named the filament. In *Sphagnum* the theca is elevated on a pedicel or leafless prolongation of the axis, of which peculiarity the anther of *Euphorbia* is a parallel instance. The thecæ are one-celled, yet they have a columella, which may be likened to the connectivum; and although the connectivum usually divides the anther into two cells, *Callitriche* is an instance in which there is but one cell; and there are examples in which the cavity is spuriously divided into four cells, as in *Tetratheca*, which in this respect resembles the theca of *Polytrichum*; and in the fact of evacuating its contents by a single pore, resembles the general structure of thecæ. All thecæ are lined by a distinct membrane, and so nearly does this resemble the endo-

thecium of an anther, that in *Jungermannia multifida* its tissue is fibrous. The remarkable manner of the development of sporules and pollen is a most convincing analogy; they are developed in unions of fours in the *cavities* of simple cellules; in fact, they are secretions in the cellules which occupy the interior of the theca or anther, and are the only instances on record within my knowledge, of organized secretions in the cavities of simple cellules. Although the tetrahedral union of both sporules and pollen is almost always dissolved at an early period, yet in some instances, as in *Œdipodium* and *Erica Tetralix*, it remains at maturity. Again, neither sporules nor pollen ever have the slightest apparent organic connexion with the parent plant,—a most remarkable coincidence, and a fact which has never been insisted on as a distinguishing character between sporules and seeds*.

Then to apply, as it were, the precision of a chemical test, if sulphuric acid be applied to the sporules, the same phenomena occur as when it is applied to pollen. The effects of this test vary according to the nature of the contents of the sporule and the manner of its application, which must be carefully regulated to ensure a satisfactory result. If the sporules of *Gymnostomum truncatulum*, the contents of which are almost entirely fluid (Tab. XXXV. fig. 1.), be submitted to its action, they will burst, and a portion of the fluid will be discharged in various-sized globules (Tab. XXXV. fig. 2.). No precaution that I know of will ensure a different result in this species; but if sporules whose contents are chiefly granular, such as those of *Leskea sericea*, *Tortula ruralis* var. *lævipila*, or *Tortula rigida*, be submitted to the action of the acid, which must be added to the water very cautiously and gradually,

* I am aware that the sporules of *Anthoceros punctatus* are described by Hooker as being attached by a stalk to a central columella; and also, that Dr. Lindley has described the sporules of *Andræa* as being attached to the columella. Dr. Lindley also describes from Brongniart and Bauer the sporules of *Salvinia* and *Azolla* as stalked. In the case of *Andræa* he is certainly incorrect; and it is quite evident, from the account he has given of the latter plants, that their structure is involved in much obscurity. If it should be decided that these bodies are really attached by a stalk to a placenta, I should be inclined to suspect that they were not *mere* sporules, for it seems improbable that bodies, developed as sporules are in the cavities of cellules, should be attached by a stalk. May not what is called the theca be an involucrum, and the supposed sporules, each of which in *Anthoceros* is described as being compounded of three or four smaller bodies, be thecæ, each containing either a single union of four sporules, like *Lycopodium selaginoides*, or only one sporule, the rest being abortive, like *Pilularia*?

a few minutes being allowed to intervene between each addition, the outer coat only of the sporules will be ruptured and the contents will be ejected in the mass, being still enveloped by the delicate internal lining membrane of the sporule. Notwithstanding all the care that may be employed, a large majority of these sporules will have both their coats ruptured, and the contents will consequently be scattered. The sporules of *Jungermannia complanata* and *J. dilatata* are much better fitted for the experiment. The sporules of the former species, in their natural state, are of a rich olive-brown colour, and are completely filled with minutely granular matter (Tab. XXXV. fig. 1.). On the addition of a small portion of acid a few of them immediately burst and the contents are scattered (Tab. XXXV. fig. 6.), but the majority acquire a border of a deep-red colour, the contents appearing to be collected more towards the centre of the cavity, and they become more irregular in shape, with a projection on one side (Tab. XXXV. fig. 2.). Upon the addition of a little more acid the outer coat is slowly ruptured, and the contents are gradually squeezed out, the passage appearing to be a work of great labour, giving an observer the idea of parturition in animals (Tab. XXXV. fig. 3.). When the contents are nearly out the action is more rapid, and they are ejected with force, the sporule recoiling and contracting the fissure with a spring, unless, as is sometimes the case, the sporule is so much lacerated as to lose its elasticity. Whilst the contents were passing out they were forcibly compressed by the orifice into an oblong shape; or, if the fissure happened to be small, they would be pressed into the form of an hour-glass; but the moment they are free they resume the globular form, and appear like a spherical mass of slimy granules of a faint greenish-blue colour (Tab. XXXV. fig. 5.). The fact of the granules being evacuated in the mass, together with the peculiar appearances which they present in the act of passing out, fully impress the observer with the belief that they are held together by some power either of a gelatinous cohesion of the granules amongst themselves, or by their being inclosed in a membranous sac. This last supposition is proved to be the real fact, by allowing the sporules to remain in the acid for twenty-four hours, when the mass of granules will be found to have contracted into a smaller and apparently organized body, which in some of the instances may be clearly ascertained to be surrounded by a highly delicate translucent membrane in the form of a hollow sac, about

the same size as the mass of granules before it had contracted (Tab. XXXV. fig. 8.). This sac is so extremely pellucid, that it requires an excellent lens and of great power to exhibit it, and the observer will perhaps have to examine many masses of granules before he will find one inclosed in this sac. I am at a loss to account for the fact of so few of the masses exhibiting the sac, unless it be that the sac is ruptured by the contraction of the granules. Many of the sporules will not evacuate their contents by the action of the acid; and the same contraction of the mass of granules takes place in these, although, from being surrounded by the outer coat of the sporule, the delicate internal sac cannot be seen (Tab. XXXV. fig. 7.)*. The empty shell of the sporule is dotted all over on its outer surface with minute brick-red coloured particles, which become of a more dingy colour the longer they are exposed to the acid (Tab. XXXV. fig. 4 & 7.). After the sporule is evacuated, or even when not empty, if it has been exposed a short time to the action of the acid, the projection which was mentioned before (Tab. XXXV. fig. 2.) may be ascertained to be more transparent than any other part of the surface, and to be marked by three radiating lines (Tab. XXXV. fig. 7 *a.*), which, I presume, indicate the point of attachment to the three other sporules that formed the tetrahedral union in the young state. The sporules of *Orthotrichum striatum* (Tab. XXXV. fig. 1.) are an instance in which the strongest acid seems scarcely to have sufficient power to rupture the outer coat, for it is only after a little maceration in the acid that a few of them are ruptured (Tab. XXXV. fig. 3.) and discharge their contents in the mass (Tab. XXXV. fig. 4.). The contents of these sporules are very much contracted by the acid before their expulsion, but immediately expand to their original size on gaining their liberty. Tab. XXXV. fig. 5. represents an unruptured sporule after a maceration of twenty-four

* This is not the cause of the internal sac being concealed; for I find upon washing the sporules free from the acid and adding diluted spirit, that the internal sac becomes visible; from which I conclude, that the sac was in close apposition with the outer coat until the contracting influence of the spirit on the membrane separated it.

In the course of these experiments I have ascertained that sulphuric acid is a valuable agent in the analysis of the peristomes of Mosses. In common with my friend Mr. Wilson, (who, however, is entitled to the merit of priority,) I have long entertained the opinion that all single peristomes are in reality double, but in a state of cohesion; and I find that sulphuric acid, in the case of *Tortula rigida*, the only instance I have tried, destroys this cohesion, causing the hitherto supposed single peristome to split up into an internal and external layer, the former of which is nearly white and the latter red.

hours, in which the red granules on the surface appear to have been partially removed by the action of the acid. It is clear, from this instance, that the outer coat is in itself colourless and pellucid.

Lastly, to complete the analogy, the sporules of Mosses and of some other tribes commence their germination by the emission of the internal lining membrane in the form of a tube, which is exactly analogous to the pollen-tubes. In the Mosses these tubes increase by the addition of a series of fresh tubes at their extremities, and at length a bud containing the rudiments of stem, leaves and roots is formed, which may be considered analogous to the embryo or young bud in the seed of the more highly organized plants.

Tintinhull, near Ilchester,
Feb. 18, 1839.

EXPLANATION OF THE PLATES.

TAB. XXXV.

Fig. 1. Plants of *Œdipodium Griffithianum*, of the natural size.

Fig. 2. A plant magnified.

The following Figures are all highly magnified.

Fig. 3. A leaf.

Fig. 4. Apex of a leaf.

Fig. 5. One of the gemmiform bodies which are found in the axillæ of the leaves.

Fig. 6. Transverse section of the same.

Fig. 7. Calyptra.

Fig. 8. Longitudinal section of a mature theca and upper part of the seta, passing through three of the stomata.

Fig. 9. Transverse section of a very young theca. *a*. The two layers of the thecal membrane. *b*. The two layers of the sporular membrane. *c*. A layer of sporules. *d*. Three layers of mother-cells, in which the sporules have not yet been secreted. *e*. The columella.

Fig. 10. One of the mother-cells, with its partially developed sporules removed and more highly magnified.

Fig. 11. A quaternary union of sporules in their mother-cell, somewhat advanced; each sporule contains globules of fluid and a few granules.

Fig. 12. A more advanced union of sporules.

Fig. 13. A different view of sporules in the same stage. The two minute points on the opposed faces of the upper sporules I believe to be analogous to the stalks which connect the sporules of *Pilularia* in the young state.

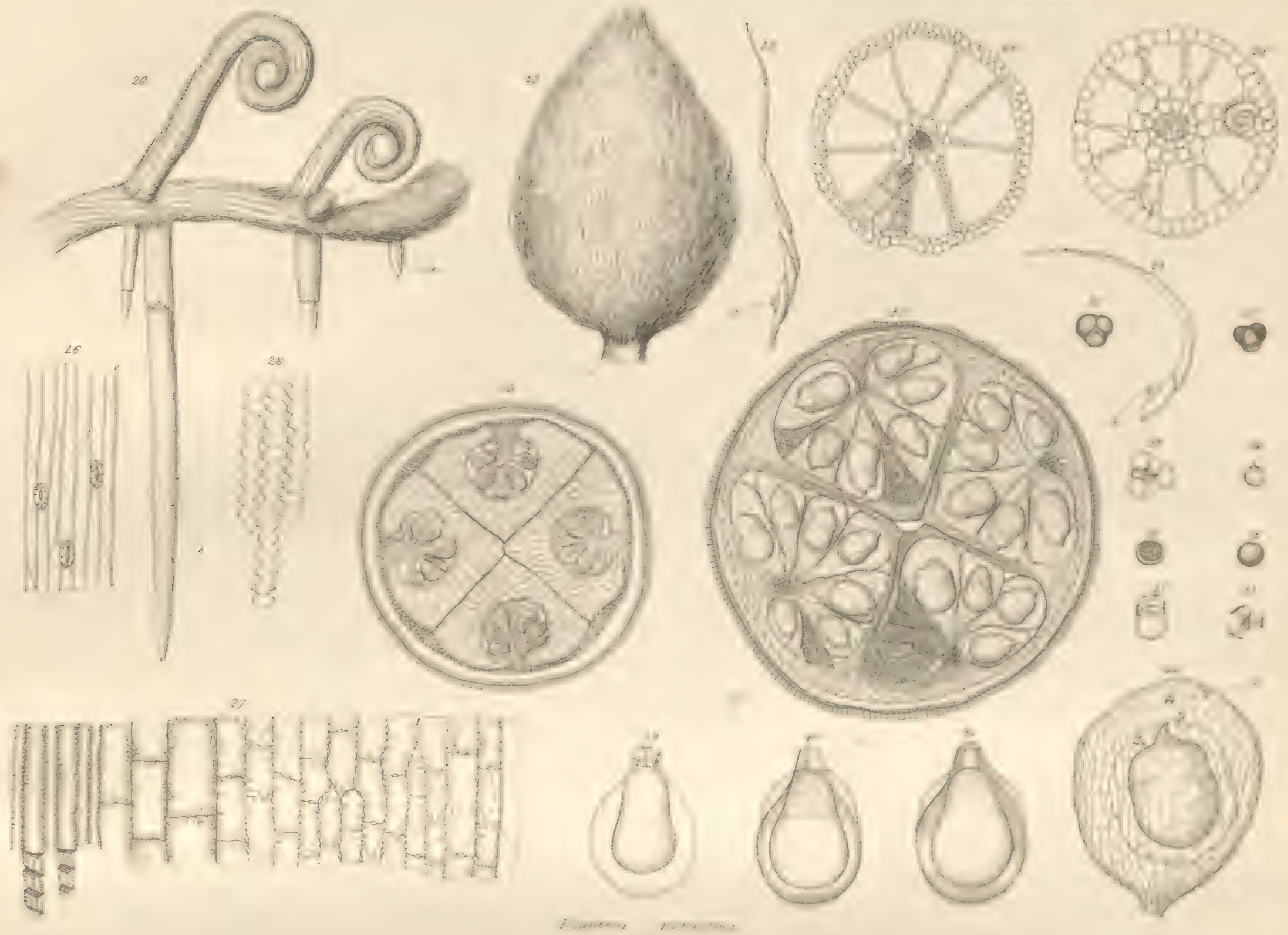
Fig. 14. A sporule, which has separated from the others by the bursting of the mother-cell.

Fig. 15. A sporule, which has been separated by a forcible rupture of the mother-cell, a portion of which still surrounds the sporule, but in a shrivelled state, appearing as if it had been overstretched.

Fig. 16. An instance in which only one sporule has been developed in a mother-cell. I could discover no signs of the stalk or radiating lines.

Fig. 17. Ripe sporules. This is an instance where the union has not been dissolved, as it perhaps usually is at an earlier period. The surface of the sporules, at least as much as is exposed, is completely covered with brownish granules. There are no signs of the mother-cell.

Fig. 18. One of the last sporules, forcibly separated to show the three radiating lines and the minute stalk. No granules could be deposited on the surface at this point on account of the cohesion of the sporules.



Œdipodium Griffithianum

XXXII. *Notice of a Plant which produces perfect Seeds without any apparent Action of Pollen.* By Mr. John Smith, *A.L.S.*

Read June 18th, 1839.

THE subject of this notice is a native of Moreton Bay, on the east coast of New Holland, and its introduction is due to the late Mr. Allan Cunningham, who sent three plants to this garden in 1829*. Mr. Cunningham not having seen the plant either in flower or fruit, could not determine to what order it belonged; but from its general habit, and from the presence of stipules, he described it as a "scrubby Ilex-leaved plant, probably belonging to *Urticeæ*." Cultivation has not altered its habit, for the plants continue to be irregularly branched, rigid, evergreen shrubs, about three feet high, of a harsh aspect, with alternate leaves, on a short petiole, which, as well as the young branches, is covered with short hairs: the leaves are elliptical, marginate, and furnished generally on each side with three acute lobes, each of which, as also the apex, is terminated by a short spine (similar to those of some species of *Ilex* and *Berberis*); and the stipules are small, subulate, and persistent.

Shortly after their introduction the plants produced female flowers, an examination of which proved the genus to be Euphorbiaceous, and allied to *Sapium*: but although I have watched them carefully from year to year, I have been unsuccessful in detecting anything like male flowers or pollen-bearing organs; and I should naturally have passed them over as diœcious, and considered the three introduced individuals as females, had not my attention been particularly directed to them in consequence of each of them producing fruit and perfect seeds, from which I succeeded in raising young plants. This, too, was not the result of one year, but of several successive years' sowing: the plant now exhibited to the Society was raised last year,

* Mr. Brown informs me that he collected specimens of this plant, but equally without fructification, at Keppel Bay, on the same coast, in 1802.

and the similarity of the offspring to the parent would alone lead me to conclude that it is not the result of cross-fecundation. The circumstances connected with the situation of the plant in the garden, and the absence of allied male plants, as also the peculiarity of the natural order to which it belongs, which do not readily hybridize, led me to believe that no foreign pollen had fecundated the ovarium; and on watching the progress of the stigma all doubts were removed. The inflorescence is produced on the apex of small lateral branches in spikes of generally from three to five or more flowers: in its early stage, a reddish disc is seen seated within five or six small, subulate, villose, erect sepals; and on examination the disc is found to be a dilated, three-lobed, sessile stigma, and the sepals to be placed around the base of the ovarium. Each flower is seated on a thick, very short pedicel, studded with from one to four or five round, prominent, papilliform, shining glands, from which, in the young state, exudes a colourless viscid fluid. This fluid remains for some time on the surface of the glands in the form of a globule, and the terminal flower always has the greatest number of glands. The ovarium is three-celled, each cell containing one ovulum, attached to the apex of the inner angle of the cell; and in the course of four or five months the seeds are perfected and discharged with elastic force from the capsule; the whole presenting the usual structure of *Euphorbiaceæ*, such as it occurs in *Croton*, *Phyllanthus*, *Cluytia*, &c. I have already said, that the stigma consists of three connate lobes, which are more or less notched; at first the lobes are depressed on the ovarium, but as the ovarium swells they lose their reddish colour and become inclined upwards, retaining their succulent and healthy appearance till dried up by the ripening of the fruit: the surface has a granular appearance, derived from minute papillæ, and showing no signs of having been acted upon by pollen. Spiral vessels occur in the thick part of the base of the stigma, and are doubtless connected with the vascular tissue of the ovarium. I have seen nothing like pollen-tubes. The stigmatic surface remaining so long unchanged affords a strong proof of its not having been acted upon by pollen, it being well known that the stigma of many plants remains for a long time unaltered, but soon after the application of pollen a change takes place, as is readily seen in *Orchideæ*.

On considering the circumstances above noticed, and in particular the

absence of male flowers of the plant itself or of others related to it, and the fact of the stigma remaining so long unchanged, and not exhibiting the symptoms usually seen in stigmas after having been acted upon by pollen, I can arrive,—especially after the length of time during which I have watched it,—at no other conclusion than that pollen is not essential to the perfecting its seeds; but if an external agent be necessary, and really act upon the stigma, I am unable to say what that agent is or how it acts. I might mention a view which I at one time entertained, namely, that the viscid fluid which issues from the glands situated below the ovarium might produce some effect by exciting the action of the pistillum; and this view received some support from finding the young stigma often smeared with the fluid. That there is some specific action on the ovula I think there can be no doubt; for, as in most other plants, some of the ovula are frequently abortive.

My object being merely to state the facts observed respecting this plant, without the intention of advancing any opinion on the various theories of vegetable impregnation, I shall conclude by merely observing, that the absence of pollen in this instance is irreconcileable with the theory that every grain of pollen furnishes a germ, and that the ovulum is merely a matrix to receive and nourish it till it becomes a perfect seed.

It is difficult to say whether this plant should be placed in any of the numerous genera of *Euphorbiaceæ* already described, the fruit scarcely differing from that of several well-known genera of the order: from its habit I had considered it to bear some affinity to *Sapium*, and for that reason had given it the name of *Sapium Aquifolium*; but on reviewing all its characters, I am now inclined to believe it to be a new genus, to which the name of *Cœlebogyne* may be given.

Royal Botanic Garden, Kew,
June 3, 1839.

EXPLANATION OF TAB. XXXVI.

Fig. 1. Part of a fruit-bearing branch of *Cœlebogyne ilicifolia.*

Fig. 2. A. Young flower-bud, showing the sepals and bracts.

B. Vertical section of the same. *a.* Sepals. *b.* Stigma. *c.* Ovarium, showing the ovula. *d.* Glands.

Fig. 3. C. A flower further advanced. *a.* Stigma. *b.* Ovarium. *c.* Glands. *d.* A lateral flower-bud.

D. A vertical section of the same.

Fig. 4. E. A spike of flowers, the ovaria advancing towards maturity.

F. One of the same detached.

G. Vertical section of the same.

H. Transverse section of the same. *a.* Stigma. *b.* Ovarium. *c.* Glands. *d.* Ovula.

I. Vertical section of the glands.

N.B.—The whole of the above figures, with the exception of the first, which is of the natural size, and has been added by Mr. Kippist, are from the pencil of the late Mr. Francis Bauer, and are magnified ten times.

Fran. Bauer del.

XXXIII. *A Monograph of the Genus* Disporum. *By* David Don, *Esq.*, *Libr. L.S.*, *Prof. Bot. King's Coll. Lond.*

Read November 19th, 1839.

To Mr. Brown is due the merit of having first pointed out the chief characters of this genus, and among others its binary ovula, which doubtless suggested to Salisbury the name of *Disporum*, subsequently given to it by that botanist in a list of Petaloid Monocotyledons, printed in the first volume of the Transactions of the Horticultural Society of London. The genus, however, remained undescribed, and almost unnoticed, until the publication of my little work on the plants of Nepal, in which I gave a detailed description of it, and added to it two other species, namely, the *Uvularia Pitsutu* of Buchanan Hamilton, and the *Uvularia parviflora* of Wallich. Sir J. E. Smith, in an article appended to that on *Uvularia*, and inserted in the 30th volume of Rees's Cyclopædia, has referred the former plant to Michaux's, or rather Richard's genus *Streptopus*, with the name of *peduncularis*. To this view of its affinities he was most probably led by the account of the fruit given by Buchanan Hamilton in his manuscript notes, for the specimen of the plant from that learned botanist in the Smithian Herbarium is without fruit. The characters of the genus consist in its campanulate perianthium, with the sepals produced into a short pouch or spur at the base, in the cells of its ovarium bearing two ovula, in its baccate pericarpium, and in its umbellate inflorescence. These distinctions will be found to be common to all the Asiatic species hitherto improperly referred by most botanists to *Uvularia*. As *Disporum* is as yet but imperfectly known, having been adopted in few systematic works, and as the species, now amounting to ten, are mostly undescribed, it occurred to me that a complete account of the genus might not prove unacceptable to the Linnean Society.

This genus terminates the series of the *Melanthaceæ*, forming the transition

from that family to the *Smilaceæ*, the chain of connexion between them being rendered complete by the intervention of a new genus, of which *Streptopus lanuginosus* is the type.

In the normal group of *Melanthaceæ*, which is principally confined to North America, the floral organs are persistent, and the partial decomposition of the trimerous pericarpium is almost universal. The *Melanthaceæ* appear naturally to divide themselves into three groups, namely, the *Melantheæ* or *Veratreæ*, in which the carpels are but partially concrete, the pericarpium capsular, with usually septicidal dehiscence, the flowers frequently unisexual, the perianthium less coloured, and constantly, as well as the stamens, persistent, and the rhizoma fibrous; *secondly*, the *Colchiceæ*, in which the perianthium is more highly developed, the sepals furnished with long claws often combined into a tube, the styles long, the carpels concrete, the pericarpium capsular with septicidal dehiscence, the rhizoma bulbous, and the floral axis naked and hypogæous; and, *thirdly*, the *Anguillarieæ*, having the floral organs frequently deciduous, the styles short, as in the first group, the carpels completely concrete, the pericarpium capsular or baccate, with loculicidal dehiscence, a bulbous or fibrous rhizoma, and a leafy axis. The genus *Colchicum* establishes an evident relationship through *Sternbergia* and *Crocus* between *Melanthaceæ*, *Amaryllideæ*, and *Irideæ*. The present genus connects the family with *Smilaceæ*, and *Tofieldia* as clearly with *Junceæ*, whilst a comparison of the structure of *Uvularia* and *Erythronium* fully makes out their affinity with *Liliaceæ* or *Tulipaceæ*. In *Uvularia*, which is closely allied to *Disporum*, the perianthium is also campanulate, with imbricate æstivation; the stamens adhere to the sepals at the base, and fall off together; the pericarpium is capsular, with polyspermous cells and loculicidal dehiscence; the ovula, which are arranged in two rows, are cuneate, angular, and caruncuIate at the apex, with the raphe forming an elevated ridge along their inner side. The flowers are axillary and solitary, and the capsule is turbinately triangular, and sometimes, as in *Uvularia grandiflora*, three-lobed. The seeds are described by Linnæus, Jussieu, Smith, and others, as arillate, but incorrectly, they being furnished merely with a fleshy appendage at their apex, resulting from an enlargement of the testa at that point. The same thing occurs in *Erythronium*, a genus belonging to the *Liliaceæ* or *Tulipaceæ*, and which,

paradoxical as it may seem, differs only from *Uvularia* in its habit, less deeply separated styles, and in the strictly marginal position of the cells of its anthers.

The class of Monocotyledonous plants offers a beautiful confirmation of the truth of the doctrine of the continuity of the series of organized beings; and however much the universal existence of transition or osculant genera in this class may perplex the botanist who looks to the technical definition of his groups as the highest object of the science, we are not to exclude such genera from our researches merely because their presence renders the circumscription of our pretended natural orders more difficult, for they certainly form the most interesting part of the study of natural affinities.

Being aware of the near affinity of *Schelhammera* to *Disporum*, I was induced to examine a supposed species of that genus, which annually flowers and matures its fruit in one of the green-houses in the Royal Botanic Garden at Kew, and I found that it not only differed essentially from *Disporum*, but likewise from *Schelhammera* itself, constituting a distinct genus from both. To enable my readers the better to contrast its characters with *Disporum*, a description of that genus is subjoined to the present communication. Having, as I trust, sufficiently explained my views as to the affinities of *Disporum*, I shall now proceed to the description of the genus, and of the species belonging to it.

DISPORUM. *Salisb.*

DRAPIEZIA. *Bl.*

UVULARIÆ SP. *Ker, Wall.*

STREPTOPI SP. *Sm.*

Perianthium 6-phyllum, petaloideum, campanulatum, æquale, deciduum: *foliolis* basi saccatis v. calcaratis. *Stamina* 6, basi sepalorum inserta, simulque decidua. *Antheræ* erectæ, extrorsæ, biloculares, duplici rimâ longitudinalitèr dehiscentes. *Ovárium* liberum, 3-loculare: *loculis* biovulatis. *Ovula* collateralia, adscendentia. *Stigmata* 3, recurvata. *Pericarpium* baccatum, indehiscens, turbinato-trigonum, 3-loculare, 3-spermum, nunc abortu monospermum. *Semina* plerumque solitaria, raró bina, subrotunda, fusca, lævia, hinc convexa, inde planiuscula, hilo nudo

basilari, chalazâ subapicali dilatatâ orbiculatâ atro-fuscâ: *testâ* membranaceâ: *albumen* copiosum, corneum. *Embryo* in regione umbilicali, subclavatus, inclusus.

Herbæ (Asiaticæ) *perennes, rhizomate ramoso-fibroso, multicipite.* Caules *angulati.* Folia *dilatata, margine tenuissimè cartilagineo-serrulata, plerumque subpetiolata.* Inflorescentia *terminalis, umbellata.* Bacca *nigra, trigona, angulis apice prominentibus subtriloba.*

1. *D. calcaratum,* umbellis pedunculatis sub-5-floris, sepalis lanceolatis acutiusculis basi longè calcaratis, antheris filamentis stigmatibusque stylo triplò longioribus, foliis ovato-lanceolatis sessilibus.

Uvularia calcarata. *Wall. Cat. n.* 5087.

Hab. in montibus Silhet ad Jentya. *Gul. Gomez.* ♃. Fl. Maio. (v. s. sp. in Herb. Wall.).

Caulis erectus, prolifero-ramosus, cubitalis. *Folia* sessilia, ovato-lanceolata, acuminata, multinervia, glabra, subtùs pallidiora, 3-pollicaria, pollicem et ultrà lata, imâ basi parùm contracta. *Umbella* pedunculata, 4-flora, rariùs 2- v. 5-flora. *Pedunculus* semuncialis. *Pedicelli* angulati, vix pollicares. *Sepala* lanceolata, acutiuscula, viridia? semuncialia, basi calcarata: *calcaribus* unguicularibus, obtusis, extremitate incurvis. *Filamenta* dilatata, antheris 3-plò longiora. *Antheræ* obtusæ. *Ovarium* turbinatum. *Stylus* elongatus, triqueter. *Stigmata* obtusa, recurvata, stylo ter longiora.

This species, remarkable for the length of the spurs at the base of the sepals, was collected by Mr. Gomez on the Jentya Hills in Sylhet, a mountainous region on the north-eastern frontier of Bengal. The flowers, which appear in May, are apparently of a green colour, and vary from 2 to 5 in the umbel. The leaves are altogether sessile, not being narrowed at the base as in most of the other species. The inflorescence, as in the rest of the genus, is really terminal, although, from the prolongation of the branches beyond it, it has the appearance of being lateral.

2. *D. Wallichii,* umbellis subsessilibus sub-5-floris, sepalis lanceolatis acuminatis, calcaribus rectis abbreviatis, antheris filamentis 4-plò brevioribus, stylo stigmatibus longiore, foliis ovato-lanceolatis subpetiolatis.

Uvularia Hamiltoniana. *Wall. Cat. n.* 5088, B & C.

Hab. in Nepaliâ ad Bunipa (*Wallich*); in montibus Silhet. *F. De Silva.* ♃. Fl. Maio. (v. s. sp. in Herb. Wall.).

Caules erecti, ramosi, ulnares. *Folia* ovato-lanceolata, acuminata, imâ basi constrictâ subpetiolata, 4 uncias longa, pollicem v. sesquipollicem lata. *Umbella* subsessilis, 3-rariùs 4-v. 5-flora. *Perianthium* album, ⅝ pollicis longum. *Sepala* lanceolata, acuminata. *Calcaria* recta, obtusa, sepalis 5-plò breviora. *Antheræ* obtusæ, filamentis dilatatis 5-plò breviores. *Ovarium* ovatum. *Stylus* stigmatibus ter longior.

This is included by Dr. Wallich under his *Uvularia Hamiltoniana*; but the acuminate sepals, great length of the filaments, and the nearly sessile umbels appear to me sufficient to entitle it to be regarded as a distinct species. The above description is taken from the Sylhet specimens, but those from Bunipa in Nepal do not appear to differ in any respect.

3. *D. Hamiltonianum*, umbellis pedunculatis sub-5-floris, sepalis lanceolatis acutis, calcaribus abbreviatis recurvis, antheris filamentorum longitudine, stylo stigmatibus subæquali, foliis ovato-lanceolatis subpetiolatis.

Uvularia Hamiltoniana. *Wall. Cat. n.* 5088, A.

U. Betua. *Ham. MSS.*

Hab. in collibus Morang (*Buchanan Hamilton*); in Emodi montibus. *Royle.* ♃. (v. s. sp. in Herbb. Wall. et Royle).

Caules erecti, ramosi, 2—3-pedales. *Folia* ovato-lanceolata, acuminata, imâ basi constrictâ subpetiolata, 4—5 uncias longa, sesquipollicem lata. *Umbella* pedunculata, plerumque 5-flora. *Pedunculus* et *pedicelli* longitudine subæquales, semunciales. *Perianthium* album, semipollicare. *Sepala* lanceolata, acuta. *Calcaria* obtusa, recurva, sepalis triplò breviora. *Antheræ* obtusæ, filamentis dilatatis vix breviores. *Ovarium* turbinato-ovatum. *Stylus* stigmatibus vix longior.

Buchanan Hamilton's plant is from the Morang Hills, and his specimens are marked A in Wallich's Catalogue: to it therefore the trivial name *Hamiltonianum* is correctly applied. The specimens in Dr. Royle's Herbarium appear to be identical with those above mentioned. The umbels are distinctly

pedunculate; the sepals are considerably shorter than in the preceding species, with the spurs recurved, and the anthers as long as the filaments; whereas in the preceding they are four times shorter than the filaments.

4. *D. multiflorum*, umbellis pedunculatis sub-5-floris, sepalis spathulatis mucronatis puberulis, antheris filamentis duplò brevioribus, stylo stigmatibus duplò longiore, foliis ovato-lanceolatis subpetiolatis.

Disporum Horsfieldii. *Don in Proc. Linn. Soc. n.* 5. *p.* 45.

Drapiezia multiflora. *Bl. En. Pl. Jav.* i. *p.* 8. *Schult. fil. Syst.* vii. *p.* 312.

Uvularia Hamiltoniana. *Wall. Cat. n.* 5088, D.

Hab. in Javâ. *Horsfield.* ♃. (v. s. sp. in Herb. Wall.).

Caules erecti, ramosi, 3-pedales. *Folia* ovato-lanceolata, acuminata, imâ basi constrictâ subpetiolata, 3—4-uncialia, 1—2 pollices lata. *Umbella* sub-5-flora. *Pedicelli* unciales, pedunculo longiores. *Perianthium* semunciale. *Sepala* spathulata, mucronata, puberula. *Calcaria* obtusa, recta, sepalis 6-plò breviora. *Antheræ* obtusæ, filamentis dilatatis duplò breviores. *Ovarium* turbinatum. *Stigmata* stylo duplò breviora.

Another plant referred doubtfully by Dr. Wallich to his *Uvularia Hamiltoniana*, but there can be no question of its being essentially different from that species. The umbel is elevated on a peduncle of considerable length; the sepals are spathulate; the anthers only half the length of the filaments, and the style twice as long as the stigmas. The specimen in the Wallichian Herbarium was gathered in Java by Dr. Horsfield, after whom I had named the species in the Society's Proceedings, not being then aware of its identity with *Drapiezia multiflora*.

It is only lately that I have satisfied myself of the identity of *Drapiezia* and *Disporum*. The latter name, however, has undoubtedly the right of priority, the volume of the Horticultural Transactions in which it first appeared having been published in 1812, and my *Prodromus Floræ Nepalensis* having been completed and some copies of the work distributed before the close of 1824.

5. *D. Leschenaultianum*, umbellis sessilibus 3—5-floris, sepalis ovato-lanceolatis acutis basi gibbosis, antheris filamentis vix duplò brevioribus, stylo stigmatibus ter longiore, foliis ovatis subpetiolatis.

Uvularia Leschenaultiana. *Wall. Cat. n.* 5089.

Hab. in Peninsulæ Indicæ montibus Neelgherries dictis (*Leschenault, Wight*): in Emodi montibus ad Mussooree. *Royle.* ♃ . (v. s. sp. in Herbb. Wall. et Royle).

Caules erecti, ramosi, sesqui- v. bipedales. *Folia* ovata, acuminata, imâ basi constrictâ longiùs subpetiolata, 3-pollicaria, sesqui- v. 2 pollices lata. *Umbella* sessilis, 3- v. rariùs 5-flora. *Flores* virides. *Pedicelli* semunciales et ultrà. *Sepala* ovato-lanceolata, acuta, vix semipollicaria, basi gibbosa, vix saccata. *Antheræ* obtusæ, filamentis infernè dilatatis ferè duplò breviores. *Stigmata* revoluta, stylo ter breviora. *Ovarium* turbinato-trigonum.

The specimens in the Wallichian Herbarium of this very distinct species were collected by the late M. Leschenault de la Tour in the Neelgherries, a considerable range of mountains in the Indian Peninsula. The shorter leaves, sessile umbels, broader sepals, gibbous only at their base, and the greater comparative length of the style, will readily distinguish it. Dr. Royle's specimens from Mussooree in the western Himalayas have the leaves longer, and the flowers larger, but they otherwise agree with those from the Neelgherries.

6. *D. Pitsutum*, umbellis pedunculatis 7—9-floris, sepalis cuneato-lanceolatis obtusiusculis basi gibbosis, antheris filamentis ter brevioribus, stylo stigmatibus duplò longiore, foliis lanceolatis subpetiolatis.

Disporum Pitsutum. *Don Prodr. Fl. Nepal. p.* 50. *Schult. fil. Syst.* vii. *p.* 371.

Uvularia Pitsutu. *Ham. MSS.*

U. umbellata. *Wall. in Asiat. Res.* 13. *p.* 379. *Cat. n.* 5090.

Streptopus peduncularis. *Sm. in Rees' Cyclop. sub Uvulariâ.*

Hab. in Nepaliâ ad Chitlong (*Buchanan Hamilton*); ad Chisapany. *Wallich.* ♃ . (v. s. sp. in Herbb. Smith et Wall.).

Caules erecti, ramosi, bi- v. tripedales, crassitie digiti minoris. *Folia* lanceolata, longè acuminata, 3—5-pollicaria, semunciam lata, subtùs ad nervos scabriuscula, imâ basi constrictâ subpetiolata. *Umbella* pedunculata, 7—9-flora. *Pedunculus* vix uncialis. *Pedicelli* scabriusculi, pedunculo longiores. *Flores* lutescentes? *Sepala* cuneato-lanceolata, obtusiuscula.

infernè angustata, $\frac{3}{4}$ unciæ longa, basi gibbosa, vix saccata. *Antheræ* obtusæ, filamentis infernè dilatatis ter breviores. *Ovarium* turbinatum. *Stylus* stigmatibus recurvatis duplò longior. *Bacca* trigona, nigra, pisi majoris magnitudine, 3- v. rariùs monosperma.

The late Dr. Buchanan Hamilton originally discovered this species in 1802 at Chitlong in the valley of Nepal, and gave it the name of *Uvularia Pitsutu*, which specific appellation I adopted in my *Prodromus Floræ Nepalensis*, not being then aware that the plant had been long previously published by Sir J. E. Smith in the 30th volume of "Rees's Cyclopædia," under the name of *Streptopus peduncularis*, at the end of the article "*Uvularia*." It is a handsome species, and is well distinguished by its many-flowered pedunculated umbels, and bluntish sepals.

7. *D. parviflorum*, umbellis subsessilibus 2—7-floris, sepalis lanceolatis acuminatis basi gibbosis, antheris filamentis duplò brevioribus, stigmatibus stylo ter brevioribus, foliis lanceolatis subpetiolatis.

Disporum parviflorum. *Don l. c. p.* 50. *Schult. fil. Syst.* vii. *p.* 372.

Uvularia parviflora. *Wall. in l. c.* 13. *p.* 378. *Cat. n.* 5091.

Hab. in Nepaliâ. *Wallich.* ♃. (v. s. sp. in Herb. Wall.).

Caules erecti, ramosissimi, 1—4-pedales. *Folia* lanceolata, longè acuminata, subtùs ad nervos oramque scabriuscula, imâ basi constrictâ subpetiolata, 2—3-pollicaria, vix ultra semunciam lata. *Umbella* subsessilis, 2—7-flora. *Flores* omnibus minores, fulvi? *Pedicelli* scabriusculi. *Sepala* lanceolata, apice recurvato-mucronata, margine scabriuscula, unguicularia. *Filamenta* valdè dilatata, antheris obtusis duplò longiora. *Ovarium* subrotundo-trigonum. *Bacca* trigona, subtriloba, nigra, pisi magnitudine, 3- v. 2-, nunc rariùs abortu monosperma.

This is a well-marked species, having considerably smaller flowers, and much narrower leaves than in the rest of the genus. The umbels are nearly sessile, the sepals merely gibbous at the base, and the styles thrice as long as the stigmas. In the Wallichian Herbarium are several specimens with mature fruit, in which frequently a single seed only is perfected, the two other cells being barren.

8. *D. pullum*, umbellis sessilibus sub-4-floris, sepalis lanceolatis acutis basi brevitèr calcaratis, antheris filamentis vix brevioribus, stigmatibus styli longitudine, foliis lanceolatis subpetiolatis.

Disporum pullum. *Salisb. in Hort. Trans.* i. *p.* 331. *Schult. fil. Syst.* vii. *p.* 371.

Uvularia chinensis. *Ker in Bot. Mag. t.* 916.

Streptopus chinensis. *Sm. in Rees' Cyclop. sub Uvulariâ.*

Hab. in Chinâ. ♃. (v. v. c. et s. in Herb. Smith).

Caulis erectus, ramosus, angulatus, cubitalis, ramis triquetris. *Folia* lanceolata. longè acuminata, imâ basi constrictâ subpetiolata, subtùs ad nervos oramque scabriuscula, 3-pollicaria, semunciam et ultrà lata. *Umbella* sessilis, plerumque 3- v. 4-flora, rariùs 2- v. 5-flora. *Pedicelli* semunciales, 6-angulati, angulis scabriusculis. *Flores* intensè fulvi. *Sepala* lanceolata, acuta, subconduplicata, carinata, semuncialia, margine scabriuscula. *Calcaria* recta, obtusa, sepalis 4-plò breviora. *Filamenta* infernè dilatata, complanata. *Antheræ* obtusæ, ferè longitudine filamentorum. *Ovarium* 3-gonum, turbinatum. *Stigmata* recurvata, dorso carinata, superficie minutè papillosa, styli triquetri longitudine.

This is the species upon which the genus was originally proposed to be founded. It has been cultivated in our collections for a considerable period, having been first introduced in 1801 into the Royal Botanic Garden at Kew from China, but its actual native locality is still unknown. Its proper place in the genus is evidently near *parviflorum*, with which it accords in habit, and in several other respects. The umbels are sessile, and few-flowered; the sepals calcarate at the base; and the anthers are about equal in length to the filaments, as the style is to the stigmas. The trivial name of this species is inadvertently printed "fulvum" in the *Prodromus Floræ Nepalensis*, and in the Society's Proceedings.

Having thus completed my account of *Disporum*, I shall now add a description of the genus already noticed in my introductory remarks.

KREYSIGIA. *Reichenb.*

Tripladenia. *Don.*

Perianthium 6-phyllum, petaloideum, patens, æquale, deciduum : *foliolis* æstivatione involutis, basi biappendiculatis ! sessilibus. *Stamina* 6, toro, nec basi sepalorum inserta. *Antheræ* erectæ, extrorsæ, biloculares, duplici rimâ longitudinali dehiscentes. *Ovarium* liberum, 3-loculare : *loculis* biovulatis : *ovulis* collateralibus, erectis. *Stigmata* 3, recurvata. *Pericarpium* subbaccatum, 3-loculare, 3-valve, loculicido-dehiscens : *loculis* 1—2-spermis. *Semina* suborbiculata, hinc convexa, indc angulata v. concaviuscula, glabra, nitida, colore succinea, hilo maximè fungoso-strophiolato, chalazâ orbiculatâ concavâ fuscâ, rhaphe dimidio seminis vix breviori, elevatâ : *testâ* membranaceâ : *albumen* corneum. (*Embryo* juxta basin dorsi seminis minutus, rectus, albumine inclusus. *R. Brown.*).

Herba (Novæ Hollandiæ) *perennis, rhizomate diviso fibroso multicipite, caulibus subsimplicibus, multangulis, minutè papuloso-scabris.* Folia *amplexicaulia, ovato-lanceolata, acuminata, multinervia, subtùs punctis scabra, suprà lævia.* Pedunculi *axillares, solitarii, subfiliformes, uniflori, infrà medium subarticulati, involucelloque triphyllo lineari-subulato muniti ; internodio inferiore copiosè papuloso-scabro ; superiore longiore, læviusculo.* Flores *pallidè lilacini.* Sepala *basi biappendiculata ! appendiculis (glandulis prorsùs episepalis, nec staminum rudimentis) submarginalibus, compressis, palmato-trifidis, rarò 4-fidis, albis, lobis glandulâ luteâ minutè papillosâ capitatis.* Filamenta *subulata, distincta, basi dilatata, libera, nec sepalis adnata.* Antheræ *oblongæ, obtusæ, albæ.* Stylus *brevis, crassus, trigonus.* Stigmata 3, *subulata, recurvata, stylo vix longiora, lineâ (serie stigmatis) absorbenti longitudinali.* Pericarpium *fusco-purpurascens, subrotundo-trigonum.*

1. Kreysigia multiflora. *Reichenb. Icon. Exot. cent.* 3. *p.* 11. *tab.* 229. excl. syn. *Br. Prodr.*

Tripladenia Cunninghamii. *Don in Proceed. Linn. Soc. n.* 5. *p.* 46.

Hab. in Novâ Hollandiâ ad Illawarra. *Allan Cunningham.* ♃. (v. v. c. in Horto Reg. Kewens.).

This genus is essentially distinguished from *Schelhammera* by its sessile biappendiculate sepals; by the stamens proceeding free from the torus, unconnected with the sepals; by the cells of its ovarium bearing only two ovula; by its somewhat baccate pericarpium; and, lastly, by its axillary peduncles, which are furnished with three small verticillate bractes. The presence of appendages, the spreading sepals, free stamens, strophiolate seeds, minute embryo, axillary inflorescence, and valvular fruit remove it equally from *Disporum*.

My acute friend Mr. Smith, of the Royal Botanic Garden at Kew, first drew my attention to the remarkable appendages seated at each side within the base of the sepals, resembling those of *Parnassia*. Mr. Brown having pointed out to me the intimate connexion of these curious appendages with the sepals, and the entire absence from them of vascularity, I gladly seize this opportunity of correcting an error into which I as well as Endlicher had fallen, in considering them as imperfectly developed stamina. These appendages appear to be of the same nature as those occurring on the sepals of *Calochortus* and of many species of *Lilium*. The chalaza occupies the middle of the seed, which is considerably developed toward its outer and upper sides, and is therefore, strictly speaking, hemianatropous, the adherent funiculus, which is imbedded in the fungous enlargement of the integument or testa, not extending beyond half the length of the seed.

Regarding this remarkable plant as a new genus, I had named it *Tripladenia*; but Mr. Brown having pointed out to me its identity with the *Kreysigia* of Reichenbach, the latter name is here adopted.

In conclusion I may remark, that the cuticle of the under surface of the leaves, like that of *Paris* and *Trillium*, consists of elegant sinuously lobed, and somewhat stelliform cellules; the stomata are numerous, nearly orbicular, and completely closed, but not arranged in regular rows as in the generality of Monocotyledons. The testa is composed of cubical cellules, which are more or less irregular in their outline, and of unequal size. They have thin walls, and are furnished with a distinct elliptical nucleus. The contained fluid is of a rich amber colour, and abounds with extremely minute globules apparently of an oily nature. The albumen consists of a homogeneous mass, of a horny texture, and furnished with innumerable and regularly disposed cavities

filled with grains of fecula. The walls of the cavities or cells are very thick, and apparently continuous; they are of unequal size, and their section exhibits usually an elliptical outline.

I am indebted to Mr. Brown for pointing out to me the situation of the embryo in this genus; and I avail myself of this opportunity of correcting the inaccuracies contained in my former description of that important organ. The embryo is minute, nearly cylindrical, straight, white, and situated in a small oblique cavity of the albumen at the back of the seed a little above its base.

This highly interesting plant was discovered at Illawarra in New South Wales by my late excellent and enterprising friend Mr. Allan Cunningham, and by him introduced into the Royal Botanic Garden at Kew in 1823.

XXXIV. *A Monograph of* Streptopus, *with the Description of a new Genus now first separated from it.* *By* David Don, *Esq., Libr. L.S., Prof. Bot. King's Coll. Lond.*

Read December 3rd, 1839.

WHILE engaged in investigating the affinities of *Disporum,* my attention was naturally directed to the examination of various genera, either belonging to *Melanthaceæ,* or to families nearly related to it, and among others to the two genera which form the subject of the present paper. In my former communication I have already adverted to the new genus, of which *Streptopus lanuginosus* is the type, and I have also noticed the position which it occupies in the series of natural affinities, and that the chain of connexion between *Melanthaceæ* and *Smilaceæ* is rendered complete by means of it and *Disporum.* The new genus in question agrees with *Disporum* in its perianthium, in its binary ovula, and in its habit and inflorescence; but it differs in the position of its anthers, in its ovula being pendulous, and in its less deeply separated styles.

The genus *Streptopus* was first proposed by the elder Richard in Michaux's *Flora Boreali-Americana,* and was intended to include not only the *Uvularia amplexifolia* of Linnæus, but two other plants therein described for the first time, namely, *S. roseus* and *lanuginosus.* The two last are exclusively confined to North America, while the first is common to Europe and America.

The characters of the genus consist in its hexaphyllous campanulate perianthium, with the sepals deciduous, and furnished with a nectariferous furrow at their base; erect sagittate anthers, with short dilated filaments; three separate stigmata; and in its baccate pericarpium with polyspermous cells. These characters will be found united in *S. amplexifolius,* which must be considered as the type; and a careful comparison of it with the other species included by Richard clearly shows that *lanuginosus* must be removed from the genus. The genus, as here proposed to be limited, will comprise *S. am-*

plexifolius, roseus, and another species, first described by me under the name of *simplex* in the *Prodromus Floræ Nepalensis.* These plants have all a peculiar habit, cylindrical leafy stems, broad amplexicaul leaves, glaucous beneath, and axillary, solitary, mostly single-flowered peduncles, which in *amplexifolius* are curiously twisted at their middle. The genus undoubtedly belongs to the *Smilaceæ,* and is nearly allied to *Convallaria* and *Smilacina,* but is essentially distinguished from both by its distinct sepals, each furnished with a nectariferous furrow, separate stigmas, and polyspermous berry. With *Uvularia* it accords in habit, and in its solitary, axillary, campanulate flowers; but its innate anthers, furnished with short filaments, baccate pericarpium, and noncarunculate seeds, remove it widely from that genus.

I shall now proceed to the description of the genera, and of the species belonging to them.

STREPTOPUS. *Rich.*

Uvulariæ sp. *L.*

Perianthium 6-phyllum, petaloideum, campanulatum, æquale, deciduum: *foliolis* æstivatione imbricatis, basi foveâ oblongâ nectariferâ instructis. *Stamina* 6, basi sepalorum adnata, simulque decidua: *filamenta* brevissima, compressa, dilatata: *antheræ* erectæ, innatæ, basi subsagittatæ rimâ duplici longitudinalitèr dehiscentes. *Ovarium* 3-loculare: *loculis* multi-ovulatis: *ovulis* erectis. *Stigmata* 3, recurvata. *Pericarpium* baccatum, membranaceum, 3-loculare: *loculis* polyspermis. *Semina* duplici serie ordinata, oblonga, curvula, sulcata, testâ rugosâ subcoriaceâ.

Herbæ (hemisph. bor.) *perennes, rhizomate diviso, fibroso, multicipite.* Caules *cylindracei.* Folia *amplexicaulia, dilatata, multinervia, subtùs glauca.* Flores *axillares, solitarii, pedunculati, cernui, lutescentes, albi v. rosei.* Baccæ *globosæ, rubræ.*

1. *S. amplexifolius,* glaber; pedunculis medio convolutis appendiculatis, sepalis obtusè acuminatis, antheris sagittatis acuminatis, stigmate trilobo, baccæ loculis 6-spermis.

Streptopus amplexifolius. *Lam. et DeCand. Fl. Franc.* iii. *p.* 174. *n.* 1856. *Red. Lil.* v. *t.* 259. *Sm. in Rees' Cyclop. in loco. Duby Bot. Gall.* i. *p.* 459. *Schult. fil. Syst.* vii. *p.* 310.

S. amplexicaulis. *Poir. in Lam. Dict.* vii. *p.* 467.

S. distortus. *Mich. Fl. Bor. Amer.* i. *p.* 200. *Pursh Fl. Amer. Sept.* i. *p.* 232. *Spreng. Syst.* ii. *p.* 98.

Uvularia amplexifolia. *Linn. Sp. Pl.* i. *p.* 436. *Lam. Ill. t.* 247. *f.* 1. (mala). *Vill. Delph.* ii. *p.* 274. *Hoffm. Fl. Germ. p.* 118. *Host Syn. p.* 187. *Schk. Hand. t.* 93. (bona). *Willd. Sp. Pl.* ii. *p.* 93. *Pers. Syn.* i. *p.* 360. *Waldst. et Kit. Pl. Hung.* ii. *p.* 182. *t.* 167. (optima). *Ait. Hort. Kew. ed.* 2. *v.* ii. *p.* 246.

U. foliis amplexicaulibus. *Mill. Dict. n.* 1. *Hall. Helv. n.* 1237. *Matt. Sil. n.* 237.

U. foliis cordato-oblongis. *Roy. Prodr. p.* 29.

Convallaria dichotoma. *Thib. in Pers. Syn.* i. *p.* 373.

Polygonatum latifolium ramosum, flore albo minore. *Barr. Ic. t.* 720.

Polygonatum latifolium ramosum. *Bauh. Pin. p.* 303. *Bauh. Hist.* iii. *p.* 530. *Moris. Hist.* iii. *p.* 537. *s.* 13. *t.* 4. *f.* 11. *Raii Hist. p.* 665.

Polygonatum latifolium quartum ramosum. *Clus. Hist. p.* 276. *Ger. em. p.* 904.

Polygonatum tertium latifolium. *Tabern. p.* 1137.

Polygonatum tertium. *Clus. Pann. p.* 267. cum fig. bonâ (266).

Laurus alexandrina. *Matth. Valgr.* ii. *p.* 556. cum figurâ pessimâ. *Cam. Epit. p.* 936. cum figurâ mediocri.

Hab. in Austriæ, Styriæ, Bohemiæ, Silesiæ, Saxoniæ, Hungariæ, Helvetiæ, Delphinatus, et Pyrenæorum montibus umbrosis; inque Pennsylvaniâ et Canadâ. ♃. Fl. Junio et Julio. (v. v. c. et s. sp. in Herbb. Smith et Boott.)

Caulis erectus, ramosus, teres, glaber, lævissimus, pedalis v. sesquipedalis, infernè nudiusculus. *Folia* amplexicaulia, cordato-oblonga, acuminata, utrinque margineque glabra, membranacea, multinervia, suprà lætè viridia, lævissima, subtùs glauca, nervisque prominulis subcostata, 3—4 pollices longa, sesquipollicem et ultrà lata: lobis posticis rotundatis, invicem se imbricantibus. *Pedunculi* capillares, glabri, uniflori, medio convoluti, ibidemque appendiculâ (pedicelli alterius rudimento) subulatâ brevissimâ stipati, sesquipollicares. *Flores* odorati. *Sepala* lanceolata, obtusè acuminata, unguicularia, pallidè lutescentia, basi foveâ oblongâ nectariferâ munita,

apice recurvato-patentia. *Filamenta* brevissima, compressa, dilatata, hinc plana, inde angulo elevato carinata. *Antheræ* sagittatæ, acuminatæ, filamentis ter longiores, apice integræ. *Stylus* trigonus, ovario duplò longior. *Stigma* levitèr trilobum. *Bacca* globosa, miniata, pisi magnitudine.

This species is pretty generally diffused throughout the mountainous parts of central and southern Europe, occurring in shady woods, and flowering in the months of June and July. It was originally discovered in the year 1576 by the accurate and indefatigable Clusius, as he himself states, in shady woods on Mount Wechsel, and at Durrenstein in Austria; and a faithful woodcut and description of the plant were given by him in his *Rariorum Stirpium Historia*, which appeared in 1583. This woodcut is repeated in his *Historia Plantarum*, published in 1601; and copies from the same occur in the works of Tabernæmontanus, Gerarde, Morison, and Barrelier. There are two other original woodcuts of the plant, namely, those given in the *Epitome* of Camerarius, which appeared in 1586, and in the Valgrisian edition of Matthiolus, published at Venice in 1583. This last represents the plant wholly in fruit, and with straight peduncles. In the cuts of Clusius and Camerarius, which last is repeated in Bauhin's *Historia Plantarum*, the singular twisting of the peduncles is rudely represented. I am not satisfied that the apparent originality of the cut given by Camerarius is not due to the artist, who may have copied from Clusius, and introduced some alterations of his own, for the figure is very faulty.

Willdenow and some other writers quote as a synonym under this plant *Polygonatum ramosum perfoliatum luteum alpinum*, Barr. Ic. t. 719, which evidently belongs to *Uvularia grandiflora*, being clearly made up from Cornuti's figure of *Polygonatum ramosum flore luteo minus*, with the strange addition of the berries of the present plant.

This species is found likewise in North America, having been first observed by Michaux in shady woods in Canada, and since by Pursh on the mountains of Pennsylvania; and Dr. Beck records it as indigenous to the State of New York. It was cultivated by Philip Miller in Chelsea Garden in 1752, but the plant is even now rarely to be seen in collections. The singular contortion of the delicate peduncles appears to be for the purpose of keeping the flowers from being injured, and their fecundation impeded by coming in contact with

the leaves, and also of admitting them to a more free exposure to the air and light.

The American specimens differ in no respect from the European ones, except in their shorter leaves and peduncles.

2. *S. roseus,* hirtellus; foliis ciliatis, pedunculis recurvatis subbifloris, sepalis lanceolatis acuminatis, antheris bicuspidatis filamentorum longitudine, stigmatibus stylo 6-plò brevioribus, baccæ loculis 4—6-spermis.

Streptopus roseus. *Mich. Fl. Bor. Amer.* i. *p.* 201. *t.* 18. (mala). *Pursh Fl. Amer. Sept.* i. *p.* 232. *Sm. in Rees' Cyclop. in loco. Elliott Carol.* i. *p.* 392. *Spreng. Syst.* ii. *p.* 98. *Schult. fil. Syst.* vii. *p.* 312.

Uvularia rosea. *Pers. Syn.* i. *p.* 360. *Ker in Bot. Mag. t.* 1489. (bona).

Hab. in Carolinæ borealis montibus, et in Canadâ (*Michaux*); in Vermontiâ (*Boott*); in Sinûs S[ti] Laurentii insulis Esquimaux dictis. *Audubon.* ♃. Fl. Junio. (v. s. sp. in Herb. Boott.)

Caulis erectus, teres, striatus, simplex v. ramosus, pedalis v. sesquipedalis, infernè nudiusculus, foliisque imperfectè evolutis convoluto-vaginatis munitus: striis pilis brevissimis patulis copiosè ornatis. *Folia* amplexicaulia, cordato-lanceolata, acuminata, multinervia, membranacea, margine tenuissimè ciliata, utrinque glabra, suprà viridia, lævia, subtùs glauca, nervisque prominulis subcostata, 3-pollicaria, pollicem et ultrà lata; suprema minùs cordata, atque vix amplexicaulia. *Flores* rosei, parùm majores. *Pedunculi* capillares, subbiflori, recurvati, nec medio convoluti, densè pubescentes, semi- v. pollicares, in superiore parte caulis plerumque simplices, uniflori, appendiculati. *Sepala* lanceolata, acuminata, apice recurvato-patentia. *Stamina* perianthio vix dimidio breviora: *filamenta* longiuscula! hinc plana, inde lineâ elevatâ carinata: *antheræ* filamentorum longitudine, basi sagittatæ, apice bicuspidato-aristatæ! *Stigmata* 3, recurvata, truncata, stylo 6-plò breviora. *Stylus* staminibus longior. *Bacca* sphærica, præcedentis magnitudine, 3-locularis: *loculis* 4—6-spermis. *Semina* obovato-oblonga, parùm curvula, longitudinalitèr sulcata, apice chalazâ orbiculatâ fulvâ aucta.

A very elegant species, bearing numerous drooping pink blossoms, which are rather larger than those of the preceding species. It was discovered by

Michaux in Canada, and on the mountains of North Carolina; and Pursh states it to be likewise a native of the mountains of Pennsylvania. It is evidently a scarce plant, having been seen by but few American botanists in a wild state; and Elliott, in his interesting Flora of South Carolina and Georgia, was obliged to describe it from a dried specimen sent him by a botanical correspondent at Philadelphia.

The plant flowered in the Royal Botanic Garden at Kew in May 1812, having been introduced by the late Mr. John Lyon from North Carolina, and a figure of it was published in the September number of the Botanical Magazine for that year. In Dr. Boott's Herbarium there are specimens collected by him in the State of Vermont, and others gathered by Mr. Audubon in the Esquimaux Islands, a group of islets in the Gulf of St. Lawrence off the south coast of Labrador. Michaux's figure of this plant erroneously represents the peduncles as convolute at their middle.

3. *S. simplex*, glaber; pedunculis rectis! nudis, sepalis obtusis, antheris cordato-lanceolatis obtusis, stigmatibus styli sublongitudine, baccæ loculis 10—12-spermis.

Streptopus simplex. *Don Prodr. Fl. Nepal. p.* 48. *Schult. fil. Syst.* vii. *p.* 312.

S. candida. *Wall. Cat. n.* 5112.

Hab. in Emodi montibus ad Gosaingthan (*Wallich*); in montibus Kamaonensibus. *R. Blinkworth.* ♃. (v. s. sp. in Herb. Wall.)

Caulis erectus, ramosus, teres, glaber, lævissimus, bi- v. tripedalis, infernè nudiusculus. *Folia* amplexicaulia, cordato-oblonga, acuminata, multinervia, membranacea, utrinque margineque glabra, suprà lætè viridia, lævissima, subtùs glauca, nervisque prominulis subcostata, 3-pollicaria, sesquipollicem lata: lobis posticis rotundatis, invicem se imbricantibus. *Flores* majores, nivei. *Pedunculi* capillares, glabri, uniflori, sesqui- v. bipollicares, recti, recurvati, nudi, nec appendiculati, nec medio convoluti. *Sepala* elliptico-oblonga, obtusa, semuncialia, apice patentia, nec recurvata. *Filamenta* brevissima, hinc plana, inde angulo elevato carinata. *Antheræ* cordato-lanceolatæ, obtusæ, filamentis triplò longiores. *Stylus* trigonus, ovario duplò longior. *Stigmata* 3, longiuscula, recurvato-patentia, stylo

parùm breviora. *Bacca* rubra? cæteris paullò major: *loculis* 10—12-spermis. *Semina* obovata longitudinalitèr sulcata, parùm curvula, hinc convexa, inde biangulata, chalazâ orbiculatâ depressâ fuscâ apice instructa.

This interesting and hitherto little-known species is a native of Gosaingthan and Kamaon in the Himalaya mountains, where it was gathered by Dr. Wallich's collectors, and was first described by me in the *Prodromus Floræ Nepalensis.* The flowers are considerably larger, and more abundant, and the plant is altogether more showy than the *amplexifolius,* from which its straight naked peduncles, blunt sepals and anthers, much longer stigmata, and more numerous seeds will readily distinguish it.

PROSARTES.

Streptopi sp. *Mich.*

Perianthium 6-phyllum, petaloideum, campanulatum, æquale, deciduum: *foliolis* basi foveolatis v. saccatis. *Stamina* 6, basi sepalorum adnata, simulque decidua. *Antheræ* erectæ, innatæ, obtusæ, biloculares, rimâ duplici marginali longitudinalitèr dehiscentes. *Ovarium* liberum, 3-loculare: *loculis* biovulatis: *ovulis* obovatis, a placentæ apice pendulis! *Stigmata* 3, brevissima, recurvata. *Pericarpium* baccatum, 3-loculare. *Semina* solitaria v. rariùs bina.

Herbæ (Amer. bor.) *perennes, pube ramosâ vestitæ, rhizomate diviso multicipite.* Caules *teretiusculi.* Folia *sessilia, dilatata.* Inflorescentia *terminalis, umbellata.* Bacca *rubra.*

This very natural genus, as I have already stated, forms the transition from the *Smilaceæ* to the *Melanthaceæ,* and possesses several characters in common with *Streptopus* and *Disporum.* From the former genus it is essentially distinguished by its much more lengthened filaments, binary pendulous ovula, and terminal umbellate inflorescence,—characters in which it agrees with *Disporum*; but it differs from this last in its innate anthers, nearly concrete styles, and pendulous seeds.

The genus is remarkable for its forked pubescence; the hairs are furnished with one, rarely with two short branches, which are continuous with the cells

or articulations of which they form an integral part, being merely lateral extensions of them, and not separated by a diaphragm.

The generic name alludes to the pendulous ovula, and is derived from *προσαρτάω*, to append.

1. *P. lanuginosa*, umbellis bifloris sessilibus, sepalis lanceolatis acuminatis 3-nerviis basi foveolatis, stylo glabro, foliis cordato-ovatis subamplexicaulibus utrinque pubescentibus.

Streptopus lanuginosus. *Mich. Fl. Bor. Amer.* i. *p.* 201. *Pursh Fl. Amer. Sept.* i. *p.* 232. *Elliott Carol.* i. *p.* 393. *Sm. in Rees' Cycl. in loco. Spreng. Syst.* ii. *p.* 98. *Schult. fil. Syst.* vii. *p.* 311.

Uvularia lanuginosa. *Pers. Syn.* i. *p.* 360. *Ker in Bot. Mag. t.* 1490.

Hab. in altis montibus Carolinæ Australis (*Mich.*) ; in Pennsylvaniâ (*Pursh*) ; in montibus Kentucky. *Short.* ♃. Fl. Maio et Junio (v. s. sp. in Herb. Boott).

Caules erecti, teretiusculi, pedales v. sesquipedales, infernè nudiusculi, basi foliis 2 v. 3 imperfectè evolutis convoluto-vaginatis instructi, apice ramosi, pilis mollibus, dichotomis, 4—5-articulatis, ramulo altero brevissimo, rariùs biramulosis, undique copiosè vestiti. *Folia* sessilia, ovata, longè acuminata, membranacea, multinervia, utrinque pilis mollibus simplicibus 2—3-articulatis, articulo imo dilatato, vestita, basi rotundata, subcordata, vix ac ne vix amplexicaulia, sesqui- v. bipollicaria, $\frac{3}{4}$ unciæ lata. *Umbella* terminalis, sessilis, biflora. *Flores* penduli. *Pedicelli* semunciales, filiformes, pilis simplicibus copiosè vestiti. *Perianthium* campanulatum, luteo-virens. *Sepala* lanceolata, longè acuminata, 3-nervia, 8 lineas longa, basi foveolâ nectariferâ aucta, sed omninò simplicia, planiuscula, nec saccata. *Stamina* perianthio vix dimidio breviora, erecta, subæqualia : *filamenta* canaliculata, glabra, infernè dilatata : *antheræ* erectæ, innatæ, oblongæ, apice integræ, obtusæ, biloculares, filamentis triplò breviores : *loculis* parallelis, connatis, suturâ marginali dehiscentibus, basi liberis. *Ovarium* conicum, 3-loculare : *loculis* biovulatis : *ovulis* a placentæ superiore parte pendulis ! obovatis, ventricosis. *Stylus* triqueter, glaber, stamina parùm excedens. *Stigmata* 3, brevissima, recurvata. *Bacca* rubra, 3-locularis : *loculis* 1—2-spermis.

I am indebted to my highly esteemed friend Dr. Boott, the worthy Secretary of this Society, for native specimens of this remarkable plant, which was originally discovered by Michaux on the mountains of South Carolina, and afterwards by the late Mr. John Lyon, by whom it was introduced into our gardens in 1811. The plant flowered in May of the following year at the nursery-grounds of Messrs. Fraser, Sloane Square, Chelsea; and a figure of it appeared in the September number of the Botanical Magazine for that year. Dr. Short has since discovered it on the mountains of Kentucky. Pursh records it also as a native of Pennsylvania; but I am not disposed to place much reliance upon the stations assigned to American plants by that botanist, from their having been in many cases noted down from memory, after the lapse of some years. Although a native of South Carolina, the plant does not appear to have come under the notice of the accurate Elliott, whose account of it is copied wholly from Michaux.

2. *P. Menziesii*, umbellis sessilibus bifloris, sepalis oblongis mucronatis 6-nerviis margine revolutis basi saccatis, stylo longissimo piloso, foliis ovatis sessilibus glabriusculis.

Hab. in orâ occidentali Americæ Borealis. *Menzies.* ♃. (v. s. sp. in Herb. Smith, nunc in Mus. Soc. Linn.).

Caulis pedalis et ultrà, teretiusculus, pilis 5—8-articulatis dichotomis, ramulo laterali brevissimo, copiosè vestitus, subviscosus. *Folia* sessilia, ovata, acuminata, 8-nervia, subtùs ad nervos pubescentia, bipollicaria, unciam lata. *Umbella* terminalis, sessilis, biflora. *Pedicelli* inarticulati, pilis longioribus 6—8-articulatis dichotomis copiosiùs vestiti. *Perianthium* majus, campanulatum, flavum? *Sepala* oblonga, mucronata, 6-nervia, margine revoluta, basi saccata, $\frac{3}{4}$ unciæ longa. *Filamenta* canaliculata, infernè dilatata, glabra. *Antheræ* erectæ, innatæ, biloculares, obtusæ, filamentis plùs duplò breviores. *Stylus* staminum longitudine, triqueter, densè pilosus. *Stigmata* 3, revoluta, stylo 6-plò breviora.

In the Smithian Herbarium there is a single specimen of this highly interesting plant gathered by my venerable friend Mr. Menzies on the north-west coast of America in the voyage of discovery under Vancouver, to which he was at-

tached in the capacity of naturalist. It bears a close resemblance to some species of *Disporum*; and it moreover agrees with that genus in its sepals being produced into a pouch at their base. The flowers, which are also terminal and in pairs, are twice the size of those of the preceding, and the style is copiously hairy.

Sir J. E. Smith, in "Rees's Cyclopædia," refers to this under *Uvularia puberula* of Michaux, a plant with which the American botanists of the present day appear to be entirely unacquainted. It is unquestionably true that several examples do occur of plants being common to the mountains of the Southern States, and the western regions of North America; but it is scarcely probable that Michaux could have overlooked the striking peculiarities of the terminal inflorescence, saccate sepals, and hairy style; indeed his description seems to be wholly at variance with the present plant.

XXXV. *On some new Brazilian Plants allied to the Natural Order* Burmanniaceæ. *By* JOHN MIERS, *Esq., F.L.S.*

Read March 3rd and 17th, 1840.

I VENTURE to present to the notice of the Linnean Society the following observations on some new and interesting plants found by me in Brazil, and bearing a close affinity to *Burmannia*. They appear to constitute the types of new genera; and though at first sight they would seem to belong to *Burmanniaceæ*, I think it will be admitted that the differences they present entitle them to be considered as forming, if not a new natural order, at least a very distinct subfamily. We are already indebted to the learned Dr. Von Martius for a knowledge of several *Burmannias* indigenous to Brazil. In his *Nova Genera et Species Plantarum Brasiliensium* not only are the characters of the genus *Burmannia* ably detailed, but five Brazilian species, which he met with in the interior provinces, are there fully described. The same genus has also been met with in North America, two species having been found to which the name of *Tripterella* was given by Michaux. Seven other species have likewise been found in Africa, India, and New Holland. These are all the plants, as far as I can learn, that correspond with the character hitherto given of *Burmanniaceæ*. The North American plant described by Mr. Nuttall under the name of *Apteria setacea*, as well as two new species discovered by Dr. Blume in Java and called by him *Gonyanthes candida* and *Gymnosiphon aphyllum*, will be hereafter mentioned.

I have had no opportunity of examining any species of *Burmannia*, except *B. bicolor*, Mart., which was first discovered in 1818 by Dr. Von Martius in the province of Minas Geraës. Mr. Gardner also found the same species in 1837 in his ascent to the higher portions of the Organ Mountain-range in the province of Rio de Janeiro; and to him I am indebted for a specimen which has enabled me to comprehend more correctly the relation which my plants bear

to the genus *Burmannia.* The plants I am about to describe will be found to possess entirely the habit of *Burmannia* in their thickened rhizoma with branching fibres, an erect stem almost naked, or at most furnished with a few bracteiform leaves, and terminal flowers with a tubular petaloid perianthium, having a six-parted border composed of three sepals and three petals; stamens three, almost sessile in the mouth of the tube of the perianthium below the petals; anther-cells disjoined, opening transversely; style simple; three stigmata; capsule surmounted by the withered perianth bursting irregularly; and seeds minute, resembling those of *Orchideæ. Burmannia,* however, possesses a trilocular capsule, with numerous seeds attached to a central placenta formed by the united margins of the dissepiments, while in all my plants the capsule is always one-celled, the seeds being attached to three thickened parietal placentæ,—a difference of no small amount. They vary moreover from *Burmannia* in the mode of dehiscence of the capsule, and in other respects, as will shortly appear.

Before entering on the description of the plants which form the subject of this paper, I will notice those before-mentioned recorded by Mr. Nuttall and Dr. Blume. That of the former is described in the "Journal of the Academy of Natural Sciences of Philadelphia," vii. p. 64, under the name of *Apteria setacea.* Having seen it only in a dried state, Mr. Nuttall was not able to ascertain the particular structure of the stamens, but he describes it as having a similar petaloid perianthium, without the winged appendages of *Burmannia,* an inferior ovary, a simple style, a three-lobed stigma, an erect stem with a few scattered bracteiform leaves: the difference from *Burmannia,* however, is striking in the structure of the capsule; for instead of its being trilocular with central placentation, it is unilocular with parietal placentation.

Dr. Blume's plants are described in his *Enumeratio Plantarum Javæ. Gymnosiphon,* from its unilocular capsule and parietal placentation, will arrange with the plants which I am about to describe. In regard to *Gonyanthes,* I confess that I could not clearly comprehend that author's definition of it until I had examined some species of the genus. The following is his character, slightly modified from my own observations:—

GONYANTHES. *Blume.*

Perianthium petaloideum, superum, tubulosum: *tubo* triquetro: *ore* trifido, (in sinubus laciniæ tres minores sitæ). *Stamina* Burmanniæ, laciniis (exterioribus majoribus) perianthii alterna. *Ovarium* dilatato-trigonum, triloculare; receptacula angulis perianthii opposita, semibifida. *Stylus* 1, trisulcus. *Stigmata* 3, dilatata, staminibus cohærentia. *Capsula* perianthio coronata, latè trigona, fenestrata, valvis nempè tribus lateralibus excisa, post dehiscentiam ob solutionem dissepimentorum valvis correspondentium unilocularis, polysperma. *Semina* minima, arillo membranaceo setiformi inclusa.

1. *G. candida.* Blume, Enum. Plant. Jav. p. 29.

To this may be added three unrecorded species which are contained in Dr. Wallich's Herbarium belonging to this Society. As they are not mentioned in his Catalogue, it is probable they had not been examined by that distinguished botanist. I therefore propose to characterize them as follows:—

2. *G. nepalensis,* caule erecto triquetro subaphyllo, foliis squamiformibus acutis, floribus subcymosis, perianthio 3-alato: alis rotundatis. TAB. XXXVIII. fig. 1.

Hab. in Nepaliâ.

Planta 3—4-pollicaris, albicans.

3. *G. Wallichii,* caule capillari erecto, foliis plurimis alternis bracteiformibus, floribus solitariis vel subtrichotomè cymosis pedicellatis bracteatis, perianthio angustè tubuloso: alis sublinearibus. TAB. XXXVIII. fig. 2.

Hab. in Regno Burmanico ad Kilaben.

Planta 3-pollicaris, purpurascens. *Flores* purpurei.

4. *G. pusilla,* caule capillari 1—3-floro, foliis radicalibus fasciculatis lanceolatis cuspidatis; caulinis bracteiformibus, perianthio tricarinato: alis dilatatis semiovatis. TAB. XXXVIII. fig. 3.

Tripteranthus pusillus. Wall. in Herb.

Hab. in Regno Burmanico ad Tavoy.

Planta 3-pollicaris. Perianthium albicans.

Dr. Blume makes no mention of petals in his generic character; but as they certainly exist in the Indian species, I have included a notice of them in a parenthesis. This genus will be seen to differ but little from *Burmannia*, except in the separation of the dissepiments from the pericarpium, which is hence enabled to split from wing to wing, transversely upon each face, presenting three widely-gaping apertures; and as the dissepiments become almost wholly contracted upon the central column, there results a clear passage across the capsule from one opening to the other: hence the meaning of the term "capsula fenestrata." From what I have elsewhere shown relative to the structure of the walls of the capsule in Burmanniaceous plants, it will be easy to conceive the origin of this peculiar kind of dehiscence. In like manner as in *Burmannia*, owing to the complete inflection of the margins of the carpels into one central axis, the placentæ are thrown into a position alternating with their normal one, and are consequently placed upon the axile line in the inner angle of the cells, opposite to the wings of the perianth, and of course opposite to the sepals. This explains the meaning of Dr. Blume's expression, "receptacula angulis perianthii opposita, semibifida," a definition which exactly applies to *Burmannia* also.

Of the Brazilian plants I am about to describe, the first species was found by me in the neighbourhood of Rio de Janeiro in April 1837, and then named *Dictyostega orobanchioides*; not long after which Mr. Gardner sent specimens to England in the dried state, gathered from the same spot. I had good opportunities of examining this in a living state, and of making drawings and details of it as well as of the other species which were subsequently found.

1. Dictyostega.

Char. Diff. *Perianthium* tubulosum, ovario adnatum, supernè liberum: *limbo* 6-fido: laciniis tribus alternis minoribus. *Stamina* 3, filamentis brevissimis, antherarum loculis disjunctis transversim dehiscentibus. *Stylus* simplex. *Stigmata* 3. *Capsula* 1-locularis, sub-3-valvis, polysperma, apice dehiscens: *valvulis* medio placentiferis. *Semina* minuta, scobiformia, testâ laxâ, reticulatâ, diaphanâ, nucleo quintuplò longiore.

Char. Nat. *Perianthium* monophyllum, tubulosum, petaloideum, persistens, infernè ovario adnatum: *tubo* brevi, medio constricto: *limbo* 6-diviso;

laciniis inæqualibus; 3 exterioribus (sepalis) erectis, acutis; 3 interioribus (petalis) minoribus, obovatis, concavis, erectis, subunguiculatis, marcescentibus. *Stamina* 3, e tubo infra petala orta; *filamenta* brevissima, cornuta, crassiuscula, triangularia, subsaccata, apicibus mucronatis liberis, utrinque loculum antheralem distinctum ferentibus. *Antherarum loculi* disjuncti, ovales, subbilobi, dorso affixi, anticè medio transversim dehiscentes. *Pollen* granulosum, subcereaceum, flavidum, demùm ad fecundationem idoneum (tubo longissimo ex unoquoque granulo exiliente) flocculosum. *Ovarium* adhærens, subtrigonum, suburceolatum, apice libero rotundato-trilobo, uniloculare; placentis tribus parietalibus, multiovulatis. *Stylus* rectus, tenuis, trigonus, longitudine staminum. *Stigmata* 3, divaricata, brevia, apice clavato-cyathiformia, ore cyathi subtrigono, marginibus inflexis, et tunc quasi punctis tribus glutinosis instructo. *Pericarpium* capsulare, perianthii limbo marcescente coronatum, cylindraceum, trisulcum, uniloculare, nunc evalve apice dehiscens, nunc trivalve ad basin dehiscens, marginibus irregularitèr laceris, valvulis medio placentiferis. *Semina* numerosissima, minuta, oblonga, subcompressa, scobiformia; testâ laxâ, nucleo ampliori, liberâ, membranaceâ, diaphanâ, reticulatâ, areolis magnis elongatis. *Nucleus* obovatus, inversus, processu papillæformi ad hilum spectante, in medio testæ filo complanato suspensus. Cætera ignota.

Plantæ (*brasilienses*) *rhizocarpæ, radice fibrosâ squamis membranaceis imbricatis ciliatis incanis tectâ.* Caulis *erectus, subflexuosus, simplex, vel rariùs ramis* 1—3 *erectis, alternis, cauli consimilibus.* Folia *subsessilia, adpressa, bracteiformia.* Inflorescentia *terminalis, dichotomè racemosa, vel subumbellato-cymosa, floribus pedicellatis purpurascentibus.*

Nomen e δικτυον, *rete,* et στεγη, *membrana,* propter seminis testam notabilitèr reticulatam.

1. *D. orobanchioides,* caule erecto subsimplici, racemis geminis, floribus nutantibus unibracteatis, bracteis cum pedicellis alternantibus, capsulâ subvalvatâ ecostatâ longitudinalitèr dehiscenti. Tab. XXXVII. fig. 1.

Apteria orobanchioides. *Hook. Ic. Pl. t.* 254.

Plant herbaceous, almost leafless, with a simple or branching stem, altogether

glabrous, subhyaline or opake: *root* consisting of a subligneous, somewhat fleshy, irregularly fusiform tuber, covered with numerous imbricate, obovate, acute, whitish, reticulated scales, fringed with long cilia: the root also throws out numerous threadlike branching fibres of considerable length. *Stem* erect, slender, cylindrical, subflexuose, spirally twisting, white, of rather softish texture, about ten inches in height, sometimes simple, less frequently branched. *Branchlets* erect, furnished at distant intervals with minute bracteiform leaves, and all terminated by a double spike of flowers. *Leaves* alternate, obovate, with acute tips, entire, reticulate, without any longitudinal nerve, erect and adpressed against the stem, about a line long, white, bearing a resemblance to small bractes, persistent, and distant about half, or rarely an inch, from each other. *Racemes* double, with alternate simple pedicellate flowers; pedicels first ascending, then recurved, so that each flower is pendent, four times the length of the bractes, three times the length of the flower at maturity, each furnished with a bracte similar in size and form to the stem-leaves, always either lateral or opposite, and usually a little below the origin of each pedicel. *Perianthium* adnate to the ovarium at base, above tubular, contracted below the mouth; border six-cleft, three segments or sepals being more exterior, and overlapping the alternating inner segments or petals in æstivation, white, persistent and withering, but deciduous on the bursting of the capsule. *Sepals* oblong, acute, erect. *Petals* obovate, somewhat smaller, shorter and rounder than the sepals, erect, concave, whitish, and often deciduous. *Stamens* three, arising from below the centre of each petal; *filament*, or what may rather be considered as connective, an uncinate, projecting, fleshy process, forming a sort of very small pouch attached to the perianth, and on its margin, on each side of the point, are suspended two distinct parallel anther-cells, which are ovate and rounded, somewhat two-lobed, attached by their back, of a pale yellow or almost white, bursting transversely across the middle, and displaying the pollen, which is of a dark yellow colour, composed of closely-packed somewhat waxy granules, coarser than the ordinary grains of pollen, and approximating in appearance to the pollinia of *Orchideæ*. *Ovarium* inferior, urceolate, white, hyaline, unilocular, with three parietal

placentæ, each formed of a bundle of descending vessels, the only longitudinal fibres to be seen in the whole structure. *Style* a short trigonous, trisulcate column, arising out of the convex six-grooved free summit of the ovarium, having its angles as well as the stigmata continuous with the placentary lines, and opposite to the petals. *Stigmata* three, sigmoid, divaricate, short, each terminated by a sort of cup with its margin compressed on three sides, leaving only three open points at the angles, appearing like as many glandular dots, in which is seen the thick viscous fluid with which the cup is filled: they wither with the flower, but the style is always persistent. *Capsule* rather ovate, double the size of the ovarium when the flower first expands, yellowish white, nerveless, three-valved, bursting by laceration of the membranes, each valve submembranaceous, showing in its centre the elastic horny placenta crowned by a portion of the style. *Seeds* very numerous, filling the whole cavity of the capsule, and densely radiating in close series round the placentations, very minute, scobiform, similar to those of some *Orchideæ*. *Testa* oblong, somewhat curved, truncated at the base, swelling a little in the middle, and tapering much towards the apex, consisting of an exceedingly thin transparent membrane, composed of long, rhomboidal or hexagonal cells, of which the partitions are strong and very prominent, and the intervening membrane is transparent and colourless: it presents in its centre a much smaller pyriform nucleus, which is opake, and seemingly free within the testa, inverted, and suspended by a compressed cord from the apex of the latter; the end pointing towards the hilum is contracted into a sort of nipple.

This species was found by me, at the period already stated, in the woody range of the Corcovado Mountain in the vicinity of Rio de Janeiro, at an elevation of nearly 2000 feet above the level of the sea, growing upon decaying timber, particularly on the decayed roots of palms.

2. *D. umbellata*, caule erecto simplicissimo, foliis erecto-patulis, umbellâ simplici 6—9-florâ, floribus erectis, pedicellis basi bracteatis, ovario ecostato. Tab. XXXVII. fig. 2.

Plant similar in habit to the former species, but smaller. The root is more

fibrous; the stem simple in every specimen I met with, and scarcely exceeding four inches in height. The leaves are also bracteiform, erect, but not so much adpressed. The umbel consists of six to nine pedicellated flowers; it can hardly be said to be forked, as the pedicels all possess nearly one common origin; these are somewhat erect and spreading, furnished at their base with bractes somewhat larger than the stem-leaves; the flowers are smaller, of rather a deep lilac or rose colour. The stem and leaves are likewise slightly tinged with a rosy hue.

I met with this species in February 1839, only in one spot, in a dense wood on the Organ Mountains, in the province of Rio de Janeiro, growing in loose fibrous mould; but it was at that time not sufficiently advanced to ascertain the dehiscence of the capsule or form of the seed.

3. *D. costata*, caule erecto simplici, floribus erectis, cymâ bibracteatâ, pedicellis ebracteatis, capsulâ evalvi 6-costatâ apice dehiscenti.

This plant was found on the Corcovado Mountain near Rio de Janeiro, growing near the same spot with *D. orobanchioides* and *Cymbocarpa*. It is scarcely more than three inches high, 6—7-flowered, with an aspect very similar to the last species, but the umbel is rather more forked, it has fewer bractes, the leaves on the stem are smaller, the flowers are not so large and are nearly white, and there are six distinct rounded striæ or ribs upon the pedicel and capsule. The capsule does not separate into valves, but its free conical summit bursts into three equal segments crowned by portions of the persistent style, which still remains united at its apex.

I am indebted to George Bentham, Esq. for a specimen of another very distinct species of *Dictyostega* lately collected by Mr. Schomburgk in British Guiana. The inflorescence is in a double raceme of few flowers; the perianthium is proportionally broader and shorter, not so much contracted at the middle, and the segments are more obtuse: it is marked by six ribs, and the capsule, as in the last-mentioned species, opens only at the apex. There is a bracte to each flower, not placed at the base of the pedicel, but opposite to it.

4. *D. Schomburgkii*, caule erecto subsimplici, racemis geminis paucifloris,

floribus unibracteatis, bracteis pedicellis oppositis, perianthio medio haud constricto: laciniis obtusioribus, capsulâ 6-costatâ apice dehiscenti.

Sir William Hooker, in his *Icones Plantarum*, tab. 254, has figured the first-mentioned species of *Dictyostega* under the name of *Apteria orobanchioides*; but it will be seen that this eminent botanist was under a mistake in referring the plant to *Apteria*, owing perhaps to the imperfect description given of that genus by Mr. Nuttall.

2. Cymbocarpa.

Char. Diff. *Perianthium* tubulosum, ovario adnatum, supernè liberum: *limbo* 6-fido, *laciniis* tribus alternis minoribus. *Stamina* omninò *Dictyostegæ*. *Stylus* simplex. *Stigma* trilobum; *lobis* gibboso-rotundatis, corniculis 2 subulatis erectis instructis. *Ovarium* gibboso-trigonum, uniloculare, placentis tribus parietalibus. *Capsula* 1-locularis, latere unico ad angulum superiorem tantùm dehiscens. *Semina* numerosissima, scobiformia; testâ reticulatâ nucleum vix superante.

Char. Nat. *Perianthium* monophyllum, tubulosum, petaloideum, subgibbosum, persistens, infernè ovario adnatum, supernè liberum, angustatum, ore ampliato: *limbo* 6-diviso, laciniis erectis, inæqualibus, 3 exterioribus (sepalis) acutis, sinubus rotundatis, 3 interioribus (petalis) subunguiculatis, brevioribus, ovalibus. *Stamina* 3, omninò *Dictyostegæ*. *Stylus* rectus, tenuis, trigonus, persistens, longitudine staminum. *Stigma* trilobum; *lobis* gibboso-ovatis, divergentibus, utrinque appendice longo subulato erecto incurvato auctis. *Ovarium* adhærens, subpyriforme, inæqualitèr trigonum, apice libero conico, uniloculare, placentis tribus parietalibus multi-ovulatis. *Pericarpium* capsulare, perianthio marcescente obtectum, oblongum, gibbosum, trigonum, angulis rotundatis, uniloculare, seminibus minutissimis e placentis tribus parietalibus radiantibus densè refertum, angulo superiore lacerato hians. *Semina* minuta, oblonga, scobiformia, apice attenuata; testâ nucleo conformi, reticulatâ, areolis elongatis angustissimis, costis valdè prominulis; funiculo tenui ejusdem longitudinis.

Plantæ (*brasilienses*) *rhizocarpæ, radice fibrosâ, caule simplici subflexuoso erecto.* Folia *sessilia, bracteiformia, erecta, aut adpressa.* Inflorescentia *dichotomè*

racemosa, pauciflora, floribus flavescenti-albidis basi bracteatis, pedicellis brevissimis apice abruptè declinatis subgeniculatis.

Derivatio ex κυμβη, *cymba*, et καρπος, *fructus*, propter figuram cymbiformem capsulæ post dehiscentiam.

1. *Cymbocarpa refracta.* TAB. XXXVIII. fig. 4.

Native of the Corcovado Mountain, near Rio de Janeiro.

This plant resembles *Dictyostega* very much in habit, but the singular form of the stigma and the remarkable dehiscence of the capsule sufficiently distinguish it. It grows to the height of from three to six inches, and is altogether white with a yellowish hue: it has delicate fibres branching from a simple root: the stem is generally simple, very slender, erect, often flexuose, sometimes even tortuose. The bracteiform leaves are erect and free, rather acute, and very small. The stem is terminated by a pair of few-flowered racemes, each generally with from three to six flowers upon short pedicels, with a single small bracte on its summit, where the flower is suddenly bent back at a right angle. The tubular perianthium above the portion investing the oval-shaped ovarium is very short, and gradually contracted a little below the mouth, where it again expands, and its border is divided into six unequal segments, the three erect acute sepals being alternate with the three shorter petals, which are of an oval form, and somewhat concave, more interior, and fixed by a short claw in the rounded spaces intervening between the sepals. The stamens resemble those of *Dictyostega* in all respects. The ovarium is oblong, rounded, slightly conical at its summit, where it is free from the perianthium, and from it rises an erect, slender, short style; the stigmata, each with two long subulate erect horns, according to the description given in the generic character, are of a whitish colour; they nearly fill the mouth of the tube, and are contiguous to the stamens. The somewhat trigonous capsule, crowned by the persistent withered perianthium and style, bursts only on one of its angles in the singular manner described, displaying a great number of yellowish, opake, scobiform seeds, which are crowded upon the three longitudinal, horny, parietal placentæ. It was found in the Corcovado Mountain, close to the spot where the *Dictyostega orobanchioides* occurs.

3. Apteria. *Nuttall*; olim Stemoptera *mihi.—Character reformatus.*

Char. Diff. *Perianthium* ovario adnatum, suprà liberum, subinfundibuliforme; fauce turgidâ, sacculis 3 interioribus auctâ; limbo 6-partito, laciniis acutis, æstivatione marginibus induplicatis, 3 alternis brevioribus. *Stamina* 3, fauci adnata, filamentis complanatis, e margine sacculorum ortum ducentibus, bifurcatis, ramulo singulo antherifero alato. *Ovarium* turbinatum, 1-loculare, placentis 3 parietalibus. *Stylus* longitudine staminum. *Stigmata* 3, recurvata, apice glandulifera. *Capsula* 1-locularis polysperma, sub- 3-valvis, apice 3-fido dehiscens. *Placentæ* 3, parietales. *Semina* numerosissima, scobiformia; testâ nucleum vix excedente, reticulatâ, areolis elongatis obliquè dispositis.

Char. Nat. *Perianthium* monophyllum, tubulosum, petaloideum, persistens, infernè ovario adnatum, supernè infundibuliforme; fauce prominentiis tribus (sacculis totidem interioribus conformibus) ampliatâ; limbo 6-partito, laciniis erectis, acutis, persistentibus; æstivatione sepalis tribus, marginibus basi subinflexis, supernè imbricatis, petalis tribus alternis, marginibus induplicatis, brevioribus, latioribus, submucronatis, minùs acutis: infra petala, in medio tubo sacculis tribus infundibuliformibus staminiferis ore rotundato subemarginato. *Stamina* 3, e margine sacculorum orta. *Filamenta* erecta, brevia, apice bifurcata; ramis divaricatis ejusdem longitudinis, singulis apice loculum antheralem gerentibus, alis duabus magnis petaloideo-membranaceis auctis. *Antherarum loculi* ovati, subbilobi, transversim irregularitèr dehiscentes; *polline* granuloso, subcereaceo, cohærente. *Stylus* filiformis, trigonus, erectus, persistens, longitudine staminum. *Stigmata* tria, divaricata, sigmoidea, apice clavata, subcrateriformia, ore glutinoso, discoideo, lateribus compresso. *Ovarium* inferum, oblongum, subtrigonum, apice libero, conico, uniloculare; placentis tribus parietalibus multi-ovulatis. *Pericarpium* capsulare, perianthio marcescente obtectum, 3-sulcatum, 1-loculare, enerve, apice trifariàm dehiscens, interdùm subtrivalve, ab apice ad basin irregularitèr fissum, valvulis medio longitudinalitèr placentiferis. *Semina* numerosissima, minuta, oblonga, funiculo suspensa, testâ nucleo conformi, apice subumbilicatâ, reticulatâ, areolis elongatis obliquè dispositis.

Plantæ (*Bras. et Amer. Bor.*) *rhizocarpæ, radice fibrosâ.* Caulis *erectus, subdichotomè ramosus, ramis subflexuosis.* Folia *pauca, sessilia, erecta, bracteiformia, pallida.* Inflorescentia *terminalis, uniflora.* Flores *cæteris majores, erecti, ebracteati, purpurascentes.*

1. *A. setacea,* Nutt.

On this species I need only remark, in justice to Mr. Nuttall, that he states all his materials to have been derived from dried specimens, and that he could not distinguish the nature of the stamens. Had he been able to observe the plant in its living state, he would no doubt have witnessed the curious development of those organs so peculiar to the genus. From all that he had noted and recorded of *Apteria*, there was sufficient ground for concluding that my Brazilian plant constituted a distinct genus, and accordingly I had named it *Stemoptera* from the peculiar character of the stamens, although I confess that its close approximation to Mr. Nuttall's plant had forcibly struck me. While I was preparing these details, Mr. Brown examined a specimen of *Apteria setacea* in his possession from the original locality, and identified my plant with Mr. Nuttall's genus, of which Mr. Bentham also examined another species collected by Hartweg in Mexico; these observations were kindly communicated to me, and I was favoured with the sight of a specimen, when I could perceive by transmitted light the hollow sacs in the perianthium above described, and somewhat similar winglike expansions of the filaments. I did not hesitate, therefore, to suppress my generic name and substitute for it that of *Apteria*.

2. *A. lilacina,* caule ramoso, foliis plurimis acutis erecto-patentibus, perianthio urceolato-tubuloso: laciniis exterioribus 3 lanceolatis acuminatis; interioribus 3 ovatis mucronulatis. Tab. XXXVIII. fig. 5.

A native of the Serra dos Orgãos, near Rio de Janeiro.

I have already observed, that in general habit and appearance this plant bears much resemblance to the figure Mr. Nuttall has given of his *Apteria setacea*: the singular expansion of the filaments and the swellings in the mouth of the perianthium give to *Apteria* a very distinct character from all the related genera. Its flowers are greatly larger than those of *Dictyostega* or

Cymbocarpa. It is from three to five inches in height, of a uniform whitish colour, but slightly tinged with purple. The root is composed of small fibres, close to which the stem divides, somewhat dichotomously, into several erect branches, which are sometimes flexuose; the leaves are alternate, sessile, acute, bractelike, and not quite so much adpressed as those of *Dictyostega.* The terminal solitary flowers are three-fourths of an inch long; above the ovarium the tube of the perianthium narrows into a long slender form, somewhat widening upwards, and the upper portion is suddenly enlarged to three times the diameter of the lower, and marked by three roundish oblong swellings a short distance beneath the petals: the perianthium is of a lilac colour, somewhat darker below; the border being divided into six unequal erect teeth, of which the three outer are longer and more acute, the three inner ones (petals) being somewhat broader, more obtuse, and slightly mucronulate; they show the markings of the æstivation, as described in the generic character: the three hollow cavities corresponding with the external protuberances are funnel-shaped, and terminate acutely towards the base of the tube, the margin of their orifices being rounded and deeply notched in front, whence the stamens proceed: this saccate tube bears some resemblance to the small saccate filaments of *Dictyostega* and *Burmannia,* and may be supposed by analogy to constitute part of the stamen. The filament, which appears in the emargination of the sac, is at first erect, short, round and slender, being somewhat swollen at its apex, where it is suddenly bifurcated, its arms being divaricated almost horizontally, and somewhat thrown back upon one another; at their origin they are no thicker than the simple portion of the filament, and are about the same length, but they gradually enlarge towards their summit, and terminate abruptly each by a single anther-cell, which is adnate to it by its back; attached to the rear of the filament, and originating at its base, are two membranaceous winglike appendages, joined by their inner sides just above its bifurcation, and expanding to three times its length into a gibbous oblong body on each side, erect, and somewhat connivent in a direction corresponding with the mouth of the sac: the whole stamen is of the same colour as the perianthium, but quite pale. The anther is of a pale yellowish-white, and bursts in a transverse direction, separating, as it were, its two lobes, and displaying the pollen in closely-packed cohering subcereaceous granular

masses, according with the description given of that of *Dictyostega*. That portion of the ovarium invested by part of the perianthium is of an oblong shape, tapering at its base, and of a deep reddish-purple colour, but the upper portion is free, of a pale colour, and tapers upwards in the form of a sharp cone, from the summit of which rises the erect filiform style, which attains the height of the stamens, and then divides into three very divaricate, sigmoid stigmata, each of which forms at its extremity a somewhat upright funnel-shaped cup, with an oval orifice, drawn together on the two sides, and filled with a yellowish viscid fluid. The capsule very much resembles that of *Dictyostega*, but the seeds are different: they are oblong, quite opake, of a yellowish-brown colour, and suspended by a slender umbilical cord. The testa is marked with very prominent reticulations, appearing by a common lens as if covered with twisted longitudinal lamellæ; but under a higher power it is seen to consist of elongated, hexagonal cells.

The plant was found by me in the Organ Mountains, in March 1838, in a swampy situation under the shade of a large block of granite.

I cannot close the enumeration of these plants without alluding to the two species regarded by some as distinct from *Burmannia* under the name of *Tripterella*; the one is *Tripterella capitata* of Michaux, which Von Martius considers to be the same as his Brazilian *Burmannia capitata*; but judging from the specimen in the Herbarium of the British Museum, I am inclined to believe they are two distinct species: the other is *Tripterella cœrulea* of Elliott and Nuttall, which is the same as *Burmannia bifida* of Linnæus. It is chiefly on the authority of Mr. Nuttall that *Tripterella* has been retained distinct from *Burmannia*; but as I cannot find that he has offered any evidence of an existing difference, there seems no good ground for this separation.

From the facts now adduced, we find that the *Burmanniaceæ* comprise two very distinct groups of plants, namely, those having a trilocular ovarium with central placentation, and those having a unilocular ovarium with parietal placentation. The first consists only of the two genera, *Burmannia* and *Gonyanthes*; the second contains four genera, viz. *Dictyostega*, *Cymbocarpa*, *Apteria* and *Gymnosiphon*: that they are all very closely related there cannot be any

doubt; but it appears to me, that if we adopt the principle on which *Apostasieæ* have been separated from *Orchideæ* and *Xyrideæ* from *Restiaceæ*, we are bound to class the second section as distinct from the first. If this view be admitted, I should propose to adhere to the suggestion offered by me in 1837, to arrange these new genera into a separate family, which might be called *Apteriaceæ*; but if, on the contrary, the difference of structure of the ovarium be not thought a distinction of sufficient importance to warrant their separation into two families, they must then be associated with *Burmanniaceæ*, giving to the first section the title of *Burmannieæ*, and to the second that of *Apterieæ*. But I fear that the former view, which at first sight would seem to rest on a wide and well-founded distinction, will on mature consideration be found of less value, since the extensive order of *Gentianeæ*, for instance, presents many instances of gradual transition, beginning with the unilocular capsule with parietal placentation, the margins of the valves being ovuliferous, and ending in complete central placentation and a bilocular fruit, showing numerous cases of intermediate degrees of inflection of the ovuliferous margins.

The only other observation that I shall add respecting these plants relates to the striking resemblance of their seeds with those of most orchideous plants, and the similarity in texture and structure of the pericarpium, which in both families will be found to consist of a series of closely-packed transverse ribs, seldom interrupted, proceeding from the intermediate lines where dehiscence takes place, to the placentæ. Mr. Brown has clearly demonstrated the structure of the ovarium of *Orchideæ* to consist of three carpellary leaves united by their ovuliferous inflected margins. In *Dictyostega* a similar structure is evident, only that the margins are not inflected, but are directly united by their edges, where they appear to be conjoined by an intervening, opake, reticulated line, running from the base to the apex, and forming a support to the horizontal, transverse, crowded ribs that compose the walls of the ovarium; immediately within this line is a compact bundle of longitudinal fibres forming the placenta, upon which the numerous closely imbricate ovula are attached. The same structure of the walls of the ovarium is especially visible in many species of *Pleurothallis*, though in most other *Orchideæ* the structure of the walls is very reticulate. In *Orchideæ*, the thick fleshy substance which fills

the space between the true pericarpium and the cohering perianthium consists of a mass of long, transverse cells; excepting that upon the three placentæ, as well as on two longitudinal lines in the middle of each intervening space, the membranes approach each other with scarcely any cellular tissue between them, and upon these lines the fruit easily separates (from its being necessarily weaker at those points as the capsule dries and ripens) into three broad and three narrow valves, without exhibiting any trace of those longitudinal nerves which usually form a distinct margin to capsular valves. In *Dictyostega* and the related genera there exists but a small quantity of cellular tissue between the true ovarium and adnate perianthium, and hence the capsule is almost membranaceous when ripe; but in a similar position to that exhibited in *Orchideæ*, is to be seen only a single line where the two membranes closely approximate, and which in like manner sometimes become ruptured from a similar cause, when the capsule ripens, and hence the separation into three imperfect valves is effected not by any regular fissure, but by an irregular laceration of the adhering membranes at those points where they are not strengthened by intervening tissue. On comparing also the seeds of *Pleurothallis pectinata* with those of *Dictyostega orobanchioides*, there appears scarcely any difference between them either in shape or structure, both possessing a diaphanous reticulated testa many times larger than the nucleus: in *Pleurothallis*, however, the reticulations are much smaller and more regular, and the cells constituting the areolæ are marked with spiral fibres bearing some resemblance to the spiral cells occurring in the leaves of that genus: on the other hand, the areolæ of the seeds of *Dictyostega* are much larger, longer, more transparent, and destitute of fibres. In regard to the included nucleus, the two genera offer a striking analogy, as it is in both inverted, and suspended by an elongated base from the attenuated apex of the rostelliform seed, and in both presents its nipple-like apex towards the hilum.

Besides the points of resemblance already mentioned, these plants present in other respects a striking approximation to *Orchideæ*, especially to the section of *Pleurothalleæ*, which often possess a simple erect stem with imperfectly developed leaves, and are not unfrequently destitute of the pseudobulbs, so characteristic of the tribe: they often exhibit also a regular six-

parted petaloid perianthium. An aphyllous erect stem, with imperfectly developed leaves, is also a character not uncommon to many terrestrial *Orchideæ*. Besides this, several instances are now recorded of the full development of three perfect stamens and three stigmata in orchideous plants. If these considerations alone were held in view, omitting the very material one of the stamens and stigmata, it would be difficult to draw a line of distinction between the structure of these plants and that of *Orchideæ*; but the position of the stamens, and other characters, sufficiently remove them apart.

Another analogous fact is deserving of notice: on examining the stigma of *Dictyostega* after flowering, it will be found to be crowded with bundles of white cottony filaments, which may be seen even with a common lens to consist of pollen-tubes issuing in a body from the cells of the anthers and penetrating the stigma, leaving their ends exserted, and clavately terminated by their respective grains, thus displaying in a very beautiful manner the singular mode of fecundation so ably illustrated by Mr. Brown in his admirable paper on that subject, published in the 16th volume of the Transactions of this Society. The pollen also in its texture presents great resemblance to that of the *Orchideæ*, its component granules cohering in like manner into a solid waxy mass previous to the dehiscence of the anthers.

The position of the several parts of the flower in *Dictyostega* and the allied genera will be seen to offer very peculiar characters, to an examination of which I was led by the suggestions of Mr. Brown. This profound botanist was, I think, the first who observed* that the pistilla, when distinct, or their component parts, when united, are generally placed opposite to the petals in *Dicotyledones*, while he believed the cells of the trilocular ovarium, or the component parts of the unilocular ovarium with three parietal placentæ in *Monocotyledones*, to be situated uniformly opposite to the divisions of the outer series of the perianthium; and in his learned Memoir on *Cyrtandraceæ*, lately published ("Plantæ Javanicæ," p. 110), he has given a very interesting demonstration of the structure of the ovarium, and the relation which placentæ and stigmata bear to the segments of the perianthium in several different families.

Mr. Brown considers that in *Orchideæ* the stigmata alternate with the

* Appendix to Denham's Travels, p. 243.—1826.

placentæ, a relation most usual in cases of compound unilocular ovaria where the number of stigmata and placentæ is equal; and that such is really its relation appears to him to be proved by tracing to their origin their vascular cords, which are found to coalesce with those of the three outer foliola of the perianthium. This view of the composition of the ovarium in *Orchideæ*, he observes, is confirmed by finding that it agrees with the ordinary arrangement of Monocotyledonous plants, viz. the opposition of the double parietal placentæ to the three inner divisions of the perianthium, while in *Apostasia* the three placentæ of the trilocular ovarium are opposite to the three outer divisions. The same agreement, he further observes, is found in *Scitamineæ*, both in the placentæ of the trilocular ovarium, which in this family is its ordinary structure, and in the unilocular, which is the exception. My observations upon the structure of *Burmanniaceæ* afford to that order a different arrangement as regards the position of stigmata. Dr. Von Martius, in illustrating the genus *Burmannia*, has given a figure of the pistillum of *B. bicolor*, in which the stigmata are placed opposite to the wings, and therefore alternate with the inner segments of the perianthium; but this probably may have been an error of the draughtsman, since no such position is alluded to in the text. I have in several instances opened with the utmost care the flowers of *Burmannia*, and have found the stigmata manifestly placed as I have constantly observed them in *Dictyostega* and the allied genera with unilocular capsules, viz. opposite to the stamens, and to the inner segments of the perianthium, with which the placentæ also correspond, all being alternate with the outer segments: in *Burmannia*, however, owing to the complete inflection of the carpellary leaves to form the trilocular ovarium, the placentæ thus extended to the axis will be seen directed towards the middle of the cells, and opposite to the outer segments of the perianthium, at the same time that all other parts remain as before mentioned, in a similar position to that existing in *Dictyostega*.

This deviation from the usual order of relation may probably be accounted for by the very ingenious views of Mr. Brown relative to the original composition of stigma, founded on the supposition that each simple pistillum or carpel has necessarily two stigmata, which are to be regarded not as terminal, but lateral, in the same manner that the placentæ of each carpellary leaf are

to be considered as marginal; and although a confluence of the two stigmata of each carpel is the more usual structure, he adduces some cases, of comparatively rare occurrence, in which the stigmata of the adjoining carpels are confluent, as in *Parnassia*, many *Cruciferæ*, and *Papaveraceæ*, as well as in the majority of *Irideæ*, such cases of deviation being often, according to him, obviously connected with adaptation of surface to the more complete performance of function*. These views may in like manner be applied to *Burmanniaceæ*; thus in *Dictyostega* we may conceive that there exists a confluence, not only of the ovuliferous margins of the adjoining carpellary leaves, but of the adjacent stigmata of the several carpels, differing thus from *Orchideæ*, where, in cases of their complete development, the stigmata of each carpel are united and remain distinct from those of the adjoining component part of the pistillum. The probability of this conclusion is strengthened by the appearance of the lateral lobes of the stigmata of *Dictyostega*, and by the two horn-like appendages of those of *Apteria*, as shown in the figures illustrative of these parts. Although the trilocular *Burmanniaceæ* will be seen to agree with those *Irideæ* to which Mr. Brown has referred, by having the stigmata alternate with the placentæ, they still differ from that order in having their stamens constantly opposite to the inner segments of the perianthium; and notwithstanding the close affinity shown to exist between this family and *Orchideæ*, we have here, independent of all other considerations, a sufficiently well-defined character in the position of stigmata, to establish a line of complete distinction between them.

EXPLANATION OF THE PLATES.

Tab. XXXVII.

Fig. 1. *Dictyostega orobanchioides.*

a. Flower, magnified, to show the æstivation.

b. Ditto, with the perianthium cut open, to show the stamens and pistillum.

c. Stamen, seen sideways.

d. Ditto, seen in front, with one of the cells of the anther burst.

* *Plantæ Javanicæ*, p. 110.

e. Pistillum, with the lower portion of the ovarium and some of the seeds removed, to show the parietal placentation and mode of attachment of the seeds.

f. Ditto, with clusters of pollen-tubes escaped from the anthers penetrating the stigmata.

g. Capsule, with the limb of the perianthium fallen off, in the act of bursting at the apex.

h. Ditto, cut transversely, to show the placentation and disposition of the seeds.

i. Ditto, after dehiscence, showing the lacerated margins of the valves.

k. Portion of the capsule, showing the longitudinal fibres of the placenta, the texture of the pericarpium, and the part which by laceration forms the margins of the valves.

l. Seed, magnified.

m. Seed, highly magnified, showing the transparent reticulated testa, and the included embryo; the upper end is that by which it is attached to the placenta.

n. Nucleus, showing the cord by which it is suspended from the attenuated apex of the testa.

o. One of the scales of the fleshy root, fringed with long ciliary hairs, seen from the inside, to show the reticulated structure; the outer surface presents hairs like those of the margin.—All more or less magnified.

Fig. 2. *Dictyostega umbellata.*

a. Flower, magnified, to show the æstivation.

b. Ditto, with the perianthium cut open, to show the stamens and pistillum.

c. Stamen, seen in front.

d. Ditto, seen sideways.

e. Filament, seen in front.

f. Ditto, seen sideways.

g. Pistillum, showing the three-lobed summit of the ovarium, the style and stigmata.

h. Ovarium, cut transversely, to show the placentation and disposition of the seeds.

i. Capsule, with the adhering perianthium.

k. Ditto, with a portion of the perianthium removed, to show the mode of dehiscence.

l. Ditto, with the perianthium wholly removed.—All more or less magnified.

Fig. 3. *Burmannia bicolor.*

a. Flower, cut open, to show the stamens and pistillum.

b. Ovarium, cut transversely, to show its three-celled structure and central placentation.

c. Seed.

d. Nucleus.—All magnified.

Fig. 4. *Pleurothallis pectinata.*

a. Seed, with its transparent reticulated testa and included nucleus, suspended by its base from the attenuated apex, to show its resemblance to the seed of *Dictyostega orobanchioides.*

b. Nucleus.

Tab. XXXVIII.

Fig. 1. *Gonyanthes nepalensis.*

a. Capsule, showing the mode of dehiscence.

Fig. 2. *Gonyanthes Wallichii.*

a. Capsule.

Fig. 3. *Gonyanthes pusilla.*

a. Capsule.

Fig. 4. *Cymbocarpa refracta.*

a. Flower, expanded, with its pedicel and bracte.

b. Perianthium, cut open.

c. Stamen, seen in front.

d. Ditto, seen sideways.

e. Free summit of the ovarium, with the style and stigmata.

f. Stigmata, seen in front and sideways.

g. Capsule, cut transversely, to show the placentation and disposition of the seeds.

h. Ditto, ditto, to show the mode of dehiscence.

i. Capsule, ripened.

k. Capsule, in a state of dehiscence.

l. Ditto, having shed all its seeds.

m. Ditto, with the persistent perianthium cut open, to show the cohesion of the summit of the style. In these last two figures the placentæ are seen, as well as the peculiar protuberances at their summit in the conical portion of the ovarium, which assist in the dehiscence of the apex: these protuberances are also present in the capsules of *Dictyostega* and *Apteria.*

n. Seed, greatly magnified; the testa being opake.

o. Nucleus.—All more or less magnified.

Fig. 5. *Apteria lilacina.*

a. Flower, expanded.

b. Ditto, cut open, to show the stamens and pistillum.

c. Stamen, with its supporting hollow sac cut away from the perianthium, seen in front.

d. Ditto, ditto, seen sideways.

e. Ditto, with its winged appendages, still further magnified, showing the mode of dehiscence of the anther.

f. Pistillum.

g. Stigmata, still more magnified.

h. Ovarium, cut transversely, to show the placentation and disposition of its seeds.

i. Capsule, with the marcescent perianthium.

k. Ditto, with the perianthium removed, to show the mode of dehiscence.

l. Ditto, cut open, to show the placentæ and the protuberances at their summit.

m. Seed, greatly magnified.

n. Nucleus.—All more or less magnified.

Fig. 6. View of the inner wall of the capsule of *Dictyostega orobanchioides.*

Fig. 7. Ditto of the capsule of a species of *Chlorœa* from Chili.

XXXVI. *Some Account of the* Curata, *a Grass of the Tribe of* Bambuseæ, *of the Culm of which the Indians of Guiana prepare their Sarbacans or Blowpipes. By* Robert H. Schomburgk, *Esq. Communicated by the Secretary.*

Read December 17th, 1839.

"WHAT is the monocotyledonous plant that furnishes these admirable reeds?" is the question asked by Baron Humboldt, after giving a description of the species of reed, of which the Indian Sarbacans or blowpipes are made. "Did we see, in fact," he continues, "the internodes of a grass of the tribe of *Nastoidæ*? or may this reed be a Cyperaceous plant, destitute of knots?—I cannot solve this question!"

Nearly forty years have passed since this great traveller visited Esmeralda, and observed one of the four canoes which had taken the Indians to the gathering of the Juvias (the fruits of *Bertholletia excelsa*) filled in great part with this remarkable reed; and the interval has elapsed without botanists receiving any further information on this interesting subject. No wonder, therefore, that next to the plant which furnishes the active principle of the famous Urari or Wurali poison, the discovery of the reed by means of which the Indian is enabled to send his poisoned arrow with so much precision into his intended victim, should have been a point of the greatest interest to me.

During the first of the expeditions which were undertaken in the interior of Guiana, I was fortunate enough to discover at the Cannucu mountains the plant of the bark of which the Indians make their Urari poison, and established without doubt that it is a species of *Strychnos*, which I named *Strychnos toxifera*. But in answer to all my questions to the Indians as to the locality from whence they procured the reeds that play such an important part in the construction of the blowpipe, they merely pointed to the west, and gave me to understand that it was far away. The value which the Indians of Guiana set upon these reeds, and the uncertainty from whence

they came, increased their interest; and one of my first questions on arriving at a settlement of Indians which I had not previously visited, was, whether they knew from whence were obtained these reeds, so different in structure from all known *Bambuseæ.* I ascertained at last that the Macusis received them from the Arecunas, but that they did not grow in the country of that tribe; on the contrary, the Arecunas undertook journeys of several months duration to procure them from another tribe, who lived still further westward.

During the latter part of my third expedition in the interior of Guiana, I likewise visited these Arecunas, who inhabit the northern tributaries of the Orinoco, and from whom the Macusis receive their reeds by barter; and here I received certain information that the plant which produced the reed grew in the country of the Guinau and Maiongcong Indians near the head-waters of the Orinoco.

We saw among the Arecunas a large number of these reeds, which they were manufacturing into blowpipes. The reed being so valuable, and so liable to destruction if carried openly through the woods, the Indian puts it for protection into the slender trunk of a palm (a species of *Kunthia*?), which he simply hollows out for the purpose. Being aware that the tube thus manufactured is in constant demand by the other tribes, he does not leave the regions which he inhabits to offer his ware for sale, but patiently awaits the visits of the Macusi, skilled in manufacturing the Urari poison, who brings him that deadly preparation, and exchanges it against these reeds or the ready-finished blowpipe. By this mutual exchange, they are each rendered masters of life and death over the feathered game; for, armed with his blowpipe, the wily huntsman gradually steals nearer and nearer to his victim, and launches his weapon of death, which seldom fails of its deadly aim, before the unconscious bird is even aware of the approaching danger.

The great object of my last expedition led me to that far west. We camped on the 26th of January near the river Emakuni, at a settlement inhabited by Maiongcong Indians; and the first object which struck me on entering the miserable hut which served as a dwelling to the Indians, was a large bundle of these reeds, some of which were sixteen feet long; a circumstance which naturally induced the inquiry, from whence they came. The houses being built on elevated ground, we had an extensive view before us: at the distance of

twenty miles we observed a large chain of mountains, which trended N.N.E. and S.S.W.; and among this chain a high mountain was pointed out to us, which they called Mashiatti, and where we were told that these reeds were growing; but as we were given to understand that we should find them likewise at Marawacca, and as Mashiatti was entirely out of our road, we did not visit it. It was consequently only in the middle of February, and after we had crossed the river Parima, that my wish of becoming acquainted with that curious plant was accomplished.

The Maiongcong and Guinau Indians, whom the Spaniards call Maquiritares, conducted us to that part of Marawacca (a high mountain which terminates in an almost perpendicular wall of sandstone) where the plant grows. It is a day's journey from a Maiongcong settlement on the river Cuyaca, from whence the hospitable and good-natured savages showed us the beaten track. After having ascended Mount Marawacca, to about 3500 feet above the Indian village, the traveller follows a small mountain-stream, on the banks of which the *Curas* or *Curatas*, as the Indians call these reeds, grow in dense tufts. They form generally clusters of from fifty to one hundred, which are pushed forth, as in many other species of that tribe, by a strong, jointed, subterranean rootstock. The stem rises straight from the rhizoma, without a knot, and of equal thickness, frequently to a height of sixteen feet, where the first dissepiment stretches across the inside, and the first branchlets are formed. The articulations then continue at regular intervals of about fifteen or eighteen inches to a further height of from forty to fifty feet. The full-grown stem is at the base an inch and a half in diameter, or nearly five inches in circumference. It is of a bright green, perfectly smooth, and hollow inside. The branchlets surround the culm at the nodes in small bundles, and are arranged in a verticillate manner; they are generally from three to four feet in length, very slender, terete, and nodose; the upper articulations two to three inches apart, and longer than the first, vaginated; the vagina split at the apex, persistent, striated, somewhat scabrous. The leaves are alternate, linear-lanceolate, of a bright green above, glaucescent below, nervose, striated, the midrib prominent, marginated, margin scabrous, acute; from eight to nine inches long, and five and a half to six lines broad, obliquely rounded at the base; provided with a short petiole, which is articulated to the vagina; ligulated; ligula very short and pilose.

The inflorescence is terminal and forms ramose spikes with a flexuose rachis; the locustæ or spikelets are subsessile, lanceolate, loose, from one and a half to two inches in length, and their pedicel is short and compressed*.

The whole stem is from fifty to sixty feet high; but the weight of the numerous branchlets forces the slender stem to droop, and the upper part generally describes an arch, which adds greatly to its graceful appearance. It resembles in its general appearance, if we do not regard the first nodeless joint, Humboldt's *Bambusa latifolia*, which he found in flower on the banks of the Cassiquiare. I was several times deceived, when descending the Rio Negro, into mistaking at a distance the *B. latifolia* for the *Curata*.

I estimated the height on which we found the *Curata*,—by which native name I shall distinguish it,—at about 6000 feet above the level of the sea. I have already observed, that the soil where it grew was very rich, the situation was shady, and the atmosphere humid. Its luxuriant growth in dense tufts did not allow any other plant to shoot up under it. Its distribution is very limited, and appears to be restricted to that chain of sandstone mountains which extends between the second and fourth parallel, and forms the separation of waters between the rivers Parima, Merewari, Ventuari, Orinoco and Negro. Indeed I succeeded only in ascertaining with certainty three localities, Mounts Mashiatti, Marawacca, and Wanaya.

It is a remarkable circumstance, that the plant which furnishes the chief ingredient for the preparation of the Urari poison is likewise peculiar to a few mountainous tracts; consequently the tribes who inhabit the regions where these plants grow, and who are acquainted with the mode of their preparation, acquire a general importance.

In pointing out the great differences between the tropical and extra-tropical Grasses, Schouw has noticed the much greater height which the former acquire, occasionally assuming the appearance of trees. Some of the most distinguished

* The scarcity of flowering spikelets was the reason that I examined only two on the spot, both of which were only one-flowered: the floret was hermaphrodite, and on that side of the spikelet which was furthest from the rachis. Of the few dried specimens which I have brought with me, one has been given to Mr. Bennett, who has promised to add a notice of its characters to this paper. It would be therefore superfluous to enter here into a detailed description of its sexual parts: I observe only that the anthers are of a greenish yellow, and the filaments yellow.

of this description are the *Bambuseæ*, of which the *Curata* is one of the most remarkable. But the disproportionate length of its first joint has no parallel among the other species of that tribe. As far as I could ascertain, the first joint indicates the growth of one period, which must be very short. The lateral shoots are only formed when the stem begins to increase in diameter; we saw young stems, which at the height of twenty feet, and with a thickness of scarcely a quarter of an inch, had as yet no signs of articulations.

The uncertainty which has so long prevailed as to the plant which furnishes the blowpipe-reed attests its scarcity: but this is more strikingly manifested by the circumstance that the other Indians denote the Maiongcong and Guinau tribes, who inhabit the only known regions where it grows, the Curata-people. Nature has taught the Indians of the Rio Negro and the Amazon, who have no intercourse with the Curata-people, to find a substitute in a slender palm, which they hollow out by steeping the stem for some days in water, when the internal structure may be easily pushed out by a stick. This slender tube is introduced into a larger palm in the same manner as the *Curata* into the stem of the *Kunthia*. Or sometimes the blowpipe merely consists of a single palm of any species, the interior of which has been removed and burnt out after having split the stem along its length into two parts. When this has been done and the inside has been polished, the Indian of the Rio Negro joins the two parts accurately together by an indigenous glue; and a mouth-piece of wood is added to it, which is considerably thicker than the tube. If it be considered what labour is required to accomplish this task by the aid only of a stone knife or an instrument made of the Bamboo, it becomes an obvious inference, that the *Curata*, which is so much better adapted for the purpose, does not grow in his neighbourhood.

Limited only to a few spots, the constant demand for the reeds would soon exhaust the stock, if there were not two circumstances which render it very unlikely that they will be exterminated. These are, the numerous shoots which originate from a single rootstock, combined with the rapid growth of the shoots; and the great care which the Indian takes of his blowpipe. Even when in quest of game, and winding his way through thickets which would prove almost impenetrable to an unincumbered European, he carries his blowpipe erect, and accomplishes his purpose without injury to his weapon. "A hunter," says Baron Humboldt, "preserves the same Sarbacan during his

whole life, and boasts of the lightness and precision of his Sarbacan, as we boast of the same qualities in our fire-arms."

The Indian selects only the young reeds for his weapon, as the larger would not only prove too unwieldy when encased, but would likewise require too much effort in propelling the arrow through the tube. After they have been cut to the necessary length, they are turned slowly over a moderate coal fire, which process prevents their warping, and are then exposed to the sun, where they are allowed to remain until they acquire a shining yellow colour, which the Indian considers as a proof that they contain no more moisture. They are afterwards encased; for which purpose they use the trunk of a slender palm of the tribe of *Arecinæ* (a *Kunthia* or *Geonoma*), which is steeped for a few days in water in order more easily to extract the lax tissue of which the inside consists, while the outer part is so hard that it takes a beautiful polish. This case is called by the Macusi Indians Yúrúa-Cúra-pong.

Note by JOHN JOSEPH BENNETT, *Esq., Sec. L.S.*

Mr. Schomburgk having placed in my hands specimens of the Grass which forms the subject of his communication, with a request that (if I should find it to be unpublished) I would describe it, I at first suspected it to be identical with the *Arundinaria verticillata* of Nees von Esenbeck and Kunth; but a subsequent examination has satisfied me that it is a distinct species of that genus. I have had no opportunity of comparing it with specimens of *A. verticillata*, but it differs from the description of that species given by the two eminent botanists above-named, in the following particulars. Its leaves are linear, instead of lanceolate, and smooth on both surfaces, instead of scabrous; the mouth of their sheaths is furnished on either side of the articulation of the leaf with a fringe of long rigid setæ, which are not mentioned as occurring in *A. verticillata*; its locustæ are sessile, instead of being pedicelled; and the hypogynous scales are lanceolate and acute, instead of obovate and obtuse. The following character will therefore serve to distinguish the species:—

ARUNDINARIA SCHOMBURGKII.

A. foliis linearibus acuminatis lævibus: vaginarum ore utrinque longè setoso, spicâ simplici pauciflorâ, locustis sessilibus, squamulis hypogynis lanceolatis acutis.

XXXVII. *On* Cuscuta epilinum *and* halophyta. *By* Charles C. Babington, *Esq., M.A., F.L.S., F.G.S., &c.*

Read November 5th, 1839.

In a paper which the Society has done me the honour to publish in the second part of the present volume of its Transactions, I have added my testimony to the existence of scales in the tube of the corolla of *C. europœa*, as first stated by Mr. Brown, and endeavoured to explain by their extreme difficulty of detection, even in living specimens, the fact of their not having been observed by several botanists of eminence. Since the publication of that paper I have obtained specimens of two other species, in both of which I have found these little organs, and will, with the permission of the Society, proceed to lay before it an account of the appearances presented upon an internal view of their corollas.

In the first of these plants, *C. epilinum*, Weihe, we find a ventricose tube furnished with a whorl of adpressed bifid scales, each branch of which is usually divided in a rather irregular manner into two or three fingerlike points, as I have endeavoured roughly to represent in fig. 1.; the divisions of the corolla terminate in acute points, and the stamens have very short filaments and are inserted much higher up than the extremity of the scales.

In Reichenbach's figure of this plant in his *Icones Plant. tab.* 693, the scales are very incorrectly given, each of them being there represented as two minute, separate, roundish bodies, pointing downwards. Specimens received from him (No. 19 of his *Fl. Germ. exsic.*), gathered near Borna, in the neighbourhood of Chemnitz, by M. Weicker, have however these parts of exactly the form described above, and agree in all points with the English plant, with the exception of the want of a bractea under each bunch of flowers. It is however possible, from the manner in which this bractea is hidden by the flowers in the English plant, that it may also exist in that found in Germany, although the employment of its absence as a part of the specific character is strongly opposed to this supposition. I am indebted to my friend Mr. J. E.

Bowman for the specimens examined, which were gathered near Trelydan Hall, Montgomeryshire, on the 8th of August, 1839.

The other species to which I would direct attention is a newly-discovered plant, first described by Fries in his *Novitiarum Fl. Suec. Mantissa prima* (p. 8.), under the name of *C. halophyta.* It was discovered "Ad litus marinum Norvegiæ australis, supra plantas salinas succulentas v. c. Chenopodiaceas. Dedit Blytt." For my specimen I am indebted to my friend Mr. R. B. Bowman of Newcastle-upon-Tyne, to whom it was given by Dr. Blytt himself, who gathered it "on the coast of the Fiörd near Christiania." As Fries takes no notice of the scales in this plant, it gave me great pleasure to discover their existence in my specimen, in which the tube of the corolla is ventricose, and the scales are closely adpressed to its surface; they are very similar to those of *C. epilinum,* but are more deeply bifid, and have, as I believe, bifid not trifid segments; this, however, is very difficult to determine, on account of their perfect transparency and tenacity. Fig. 2. is intended to convey a general idea of the internal appearance of the corolla of this species, whose segments are broad and obtuse, and which has its stamens placed quite at the upper extremity of the tube, far above the scales, and apparently upon filaments which are alternately long and short.

I would add to the specific characters of *C. europæa* and *C. epithymum,* which are given in my former paper, the words—calyce corollâ multò breviori,—and give the following as the characters of the plants at present under consideration.

C. epilinum, Weihe (in Boenningh. Prod. Fl. Monast. 75.) florum glomerulis bracteatis sessilibus, squamis palmato-subsexfidis tubo corollæ semper ventricoso adpressis, calycis laciniis carnosis basi deltoideis corollâ vix brevioribus.—*Corollæ laciniæ acutæ.*

C. halophyta, Fries (Nov. Fl. Suec. Mantis. p. 8.), "florum glomerulis subbracteatis" sessilibus, squamis bifidis: segmentis bifidis tubo corollæ ventricoso adpressis, calyce corollâ multò breviori.—*Corollæ laciniæ ovatæ, obtusæ. Calycis laciniæ obtusæ. Styli duo. "Glomerulos florum . . . . . . bracteatos vidi plurimos."* Fries.

St. John's College, Cambridge,
October 16, 1839.

Since the reading of this paper I have gathered *Cuscuta epilinum* among flax both in the county of Mayo and in Argyleshire, and add a description drawn from living specimens.

Segments of the calyx 5, ovate, attenuated above into an acute point, very fleshy, with peculiarly large cells; some of them often so much thickened as to become deltoid. Tube of the corolla $1\frac{1}{2}$ times as long as the limb, slightly inflated, the lobes triangular acute; stamens inserted very near to the summit of the tube; filaments short; anthers cordate; the limb of the corolla is often very fleshy. Scales bifid, each lobe either entire or 2- or 3-fid, short. Styles 2, short, bent round each other. Bractes not always present, broadly ovate, obtuse, with a minute point, often purplish. Flowers whitish-yellow, sometimes tinged with pink. Anthers bright yellow.

I have reason to believe that this plant is not a native of the British Isles, but that it has been, and continues to be, introduced with the flax-seed from Odessa and other ports of Southern Russia. Flax raised from American, and also, I believe, Riga seed, is free from this destructive parasite.

Fig. 1.

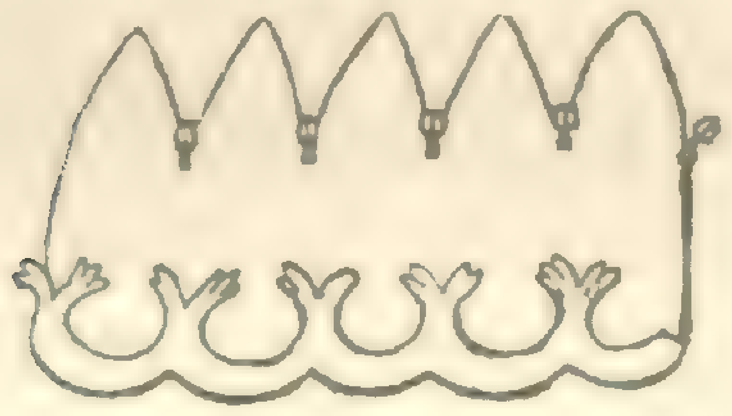


Fig. 2.

XXXVIII. *On the Reproductive Organs of* Equisetum. *By Mr.* Joseph Henderson. *Communicated by the Rev.* M. J. Berkeley, *M.A., F.L.S.*

Read June 2nd, 1840.

THERE is no part of the structure of *Equisetum* more curious or more anomalous than the organs of reproduction; and although the position of the order in the natural system depends on the nature of these organs, yet this is so far matter of doubt, that very eminent botanists do not seem decided as to whether *Equisetaceæ* are to rank among Phænogamic or Cryptogamic plants.

In the following observations* (the result of an examination continued

* These observations were made before I was aware that in part they had been anticipated. Treviranus (*a*) appears first to have observed and correctly figured the spiral vessels in the cells of which the thecæ of *Equisetum* are composed; and Meyen (*b*) confirms his observations, while he at the same time criticises, and with justice, the account given by Bischoff (*c*). There are, however, several points that appear not to have been examined, and my observations do not precisely accord with those of Meyen. I venture, then, still to offer them to the notice of the Linnean Society, trusting that I shall be excused if in any case I have been occupied on ground which has already been explored.

Since the present paper was read, Mr. I. J. Bennett has kindly pointed out to me that I have also been in a great degree anticipated by Mohl in the discovery of the peculiar mode of the production of the spore in *Equisetum*. I think it right, therefore, to give a translation of the passage in his memoir, which has been furnished by a friend.

"The young capsules (of *Equisetum variegatum*) are filled with a very delicate, polyhedral, cellular tissue. These cells are connected together in greater or lesser masses, without, however, being surrounded by mother-cells (if they are not rather themselves to be so regarded), and are filled with a granular mass. In older capsules these cells are larger and distinct from each other, and the green granular contents form for the most part a disc lying in the middle of the cell. In still more advanced capsules this green disc is changed into an oval grain, wrapped round with the two elaters. These seem to arise from the splitting of the cell in which the grain is formed, and at first surround it under the form of a closed integument. The grain itself possesses two coats, of which the outer is moderately tough, the inner very tender. I have never seen a style-like elongation like that with which Hedwig has represented the grain."—*Flora*, 1833, pp. 45, 46.

(*a*) *Von inwendigen Bau d. Gew.*, pp. 89. & 120. tab. 2. fig. 29.

(*b*) *Meyen, Pflanzen-Physiologie*, vol. i. p. 59, 1837.

(*c*) *Bischoff, die Krypt. Gew.*, i. p. 39.

from time to time on *Equisetum hyemale* and other species) I shall endeavour to show that the filaments attached to the spores of *Equisetum* are separated portions of an oval integument which envelopes the spore in its early state, and which, being attached to it on one side, and opening by spiral sutures or slits as the spore approaches to maturity, finally on its escape from the theca unrolls, and separates into two filaments with clavate tips attached by their middle to the spore. When the spike or fructification of *Equisetum hyemale* first begins to swell beyond the terminal sheath, the spores may be observed in a rudimentary state on carefully dissecting the theca, the interior of which is at this time divided into cells of extreme tenuity, in which the spores originate. These cells are filled with a viscid, greenish-coloured fluid, which, when mixed with a small portion of water and highly magnified, will be found to contain innumerable minute granules, possessing spontaneous motion, and moving apparently on their axes with considerable rapidity: they are of various sizes (fig. 5.) and of various shapes, the larger generally oblong, the lesser spherical: they are all equally active, and being transparent, they communicate a whitish colour to the water when viewed with the naked eye.

Tab. XXXIX. fig. 3. represents four cells detached by means of water, containing the spores in the position which they occupy within the cells; at first their form is oval or ovate, but they very soon change to globular, the form which they afterwards retain. It is extremely difficult at this time to detach any of these cells entire, owing to the filmy condition of their walls and the viscid nature of their contained fluid: a better opportunity is afforded of viewing their form and arrangement by macerating the theca in dilute nitric acid, when they appear somewhat shrunk and collapsed, and the minute granules are therefore easily discernible in the cells (Tab. XXXIX. fig. 4.) and also in the spores: the whole mass is easily forced asunder even to the theca, which separates into parts corresponding with the sides of the outer cells. Considerable changes take place in the spores from the state here noticed in their progress to maturity; these are accompanied by other and very remarkable changes in the theca as well as in the cells. These latter gradually acquire substance, separate from each other, and, changing their form, become first globular, and afterwards oval integuments of the spores; the spaces caused by their separation being filled up with a dark green viscid fluid containing

abundance of minute granules. If detached by means of water during the globular state, the integument has a flattened appearance (TAB. XXXIX. fig. 6.), probably owing to the inability of the membrane to preserve its proper form. At TAB. XXXIX. fig. 7. is represented the spore with its membranous integument when it has attained sufficient consistency to preserve the oval form; it has at each end an appendage of apparently more delicate membrane, the remains probably of what in an earlier state served to connect the contiguous cells. This connecting membrane—if such it be—is the only trace of any connexion between one cell or integument and another; it is very soon destroyed, and no mark of it remains in a more advanced state of the integument.

The next change which the integument undergoes is in the development of the spiral sutures, by which it is divided into two narrow bands with broad and rounded ends: at first the dividing lines are indistinctly seen traversing the integument (TAB. XXXIX. fig. 8.); after a time they become more distinct, and their spiral direction becomes evident. Two lines of separation run in a spiral direction round the integument, and meet in a sinuous transverse suture at each end (TAB. XXXIX. fig. 11.); these lines cut the integument into two equal parts, the ends of which are dilated and uniform; and these are the clavate ends of the filaments which have been considered by Hedwig and others as forming part of a sexual apparatus. The separation of the integument into parts takes place immediately after the edges of the sutures have arrived at their proper thickness; it is therefore very difficult after this to find the integument entire.

At TAB. XXXIX. fig. 9. is represented the most perfect which I have been able to find after the examination of a great number. The spore at this time contains a greenish-coloured fluid mixed with some minute granules; soon after it changes to a deeper green colour, its contents become thicker, less soluble in water, and filled with a greater number of granules; the fluid which had previously filled the integument and the rest of the theca is gradually absorbed, leaving the granules which it contained sticking in masses to the spores and to the separated portions of the integument. It is these masses of granules, when found adhering to the filaments in the ripened state of the spore, that have been mistaken for pollen-grains: when removed by means of

water, they are found to consist exclusively of the lesser granules, the larger ones having now altogether disappeared. As the spore swells, the divisions of the integument are forced asunder; a portion at each end however generally adheres longer, and preserves the form represented at TAB. XXXIX. fig. 10.; and although further separated, these divisions are still held in their spiral position until the ripening of the spore, when, being ejected from the theca, they recoil with a jerk, and immediately twist into narrow clavate filaments, the state in which they have been most frequently observed. TAB. XXXIX. fig. 12. represents the spore previous to its ripening and to the opening of the theca; the filaments are partly unrolled, and their attachment to the spore and to each other is shown.

In the ripened state the spore has a wrinkled or plaited appearance, arising from some peculiarity in its immediate covering, which appears to add greatly to its opacity. On the application of water to the spore, it immediately swells to considerably beyond its original size, the wrinkles on its surface disappear, and it changes to a bright green colour. By adding tincture of iodine to the water a very curious effect is produced, which proves the existence of an outer and inner membrane or tunic to the spore: its nucleus is contracted to a much smaller size, leaving the outer membrane occupying the space to which it had been distended by the water, and appearing under transmitted light like a transparent limb to the opake spore (TAB. XXXIX. fig. 13.). The spore on arriving at maturity acquires a dark green colour; it contains a thick viscid fluid, copiously mixed with minute granules exactly similar to those contained in the pollen-grains of flowering plants; they seem not to differ greatly from, if they are not identical with, the lesser granules found in the integument and in the intercellular cavities of the theca. The larger granules having all disappeared immediately after the separation of the integument, it would appear that their functions are somewhat different from those of the lesser ones; the former, I have no doubt, are of an amylaceous nature, being soluble in boiling water, but not in alcohol. I inclosed some spikes of *Equisetum hyemale*, in that state when the granules of both kinds are most numerous, in a phial with water; the phial was then held in a vessel of boiling water for half an hour, and on examining the thecæ, I found that the larger granules had all disappeared, but that the lesser ones remained unaltered,

and even retained their activity. Alcohol appears to produce no other effect on the granules, except the immediate suspension of their motion. Iodine acts upon the larger ones, which it changes to a bluish colour; but it produces no very obvious effect on the lesser ones, except rendering them more distinct.

I have found both these kinds of granules in the unripe thecæ of *Ferns*, of *Lycopodium* and of *Ophioglossum*: in the latter the larger ones are spherical, very numerous, and some of them very large; the whole of the cells of the theca are filled with them in the immature state of the spore, but they are mostly absorbed during its maturation, and very few remain after the discharge of the spores from the theca. Active granules exist also in some (if not all) the lower tribes of Cryptogamous plants: I have found them in the unripe thecæ of *Mosses* and of several species of *Jungermannia*, in the apothecia of *Lichens*, and in the lamellæ of *Agarics*, and the perithecia of some other *Fungi*: in some *Agarics* they are so minute as only to be rendered visible under a high magnifying power by diluting the water with iodine. On comparing these granules with those contained in the unopened anthers of flowering plants, they appear to me to be in every respect identical; in both cases, where the larger ones occur, they are similarly acted upon by iodine, and are therefore probably of the same nature; in the theca they appear to occupy a similar place with those in the cells of the anthers, and they decrease in like manner during the progress to maturity of the pollen-grain and of the spore. In the granular contents of the spore also there is the most perfect resemblance to those of the pollen-grain*. Perhaps the most obvious difference is in the entire absence of green colour from the fluid of the latter.

It has been already observed, that while the changes which have been described are in progress in the spore and its integument, considerable changes are also produced in the organization of the theca. Tab. XXXIX. fig. 1 & 2. represent two sides of that organ in its immature state, and as it appears up to the time when the spores which it contains are in the state represented at Tab. XXXIX. fig. 10. At this time it is a thin, transparent,

* In the manner in which the spores of *Equisetum*, *Ophioglossum*, *Psilotum*, and perhaps all the higher tribes of Cryptogamous plants, originate in their thecæ, there is a strong resemblance to the origin of pollen in the antheræ as described by Brongniart, namely, "in the interior of the cells of a single and distinct cellular mass."

membranous bag, flattened on two sides, and reticulated in a peculiar manner; six or more thecæ surround the pedicel of the peltate scale to which they are attached, the approximating sides being flattened, and the outer and inner edges prominent. The theca is reticulated in the following manner: three or more rows of muriform meshes placed transversely side by side run along the inner edge (Tab. XXXIX. fig. 1.); the ends of these meshes are separated by a zig-zag line (or what proves when highly magnified to be a double line), and it is at one of these lines that the dehiscence of the theca takes place (Tab. XXXIX. fig. 14. *a*.). The meshes occupying the sides and outer edge are of various forms, generally disposed in irregular rows or divided into areolæ, the meshes in each of which have a different inclination; those on the outer edge are placed longitudinally, from which the bundles of meshes on the sides are variously inclined in the direction of, and to meet the rows on the inner edge (Tab. XXXIX. fig. 2.). In this state the theca continues until the spores have attained their full size, and are changing to the dark green colour which they assume at maturity.

At this time a new deposit of vegetable matter is added to the membrane of the theca, in which spiral vessels are developed: a deposit of green granular matter is first observed round the edges of the meshes, and afterwards dispersed of a lighter colour over the whole: the development of the spiral vessels immediately follows this deposit, which seems in a great measure to be absorbed in the process, as the theca afterwards partly regains its former transparency. On first observing this deposit, it appeared to me to be formed on the inner surface of the membrane of the theca; but after examining both surfaces with a magnifying power of four hundred diameters, I found that they presented exactly the same appearance. Subsequent observations, however, have convinced me that the meshes of the theca are composed of a double membrane; that they are in fact flattened cells, the united edges of which form the boundaries of the meshes, and that the deposit in question, and afterwards the spiral vessels, are formed in the space caused by a partial separation of the two membranes. This observation is confirmed by the appearance of the meshes, which at this time have more or less of a blistered appearance, or are wholly inflated, but again collapse as soon as the spiral vessels are formed. These vessels vary according to the form of the meshes

which they occupy; those occupying the muriform and other meshes near the inner edge of the theca differ from those on the sides and outer edge; the latter are well-defined flattened spiral vessels (Tab. XXXIX. fig. 14. *b.*); the former partake more of the character of annular vessels (fig. 14. *c.*).

In a portion of the base of the theca near its insertion into the peltate scale, the organization is different from any of the above; it consists partly of fibrous cellular tissue, something like the inner coating of antheræ, and the outer surface is formed into sinuous ridges with hollow spaces between.

EXPLANATION OF THE FIGURES.

Tab. XXXIX. B.

Fig. 1. Magnified portion of the theca of *Equisetum hyemale,* showing the rows of muriform meshes on the inner edge, and irregular rows of meshes on part of the side.

Fig. 2. Portion of the theca, showing the outer edge and part of the side, on which the meshes are divided into areolæ variously inclined.

Fig. 3. Cells, detached by means of water, when the spores have arrived at the globular form.

Fig. 4. Cells, detached by means of dilute nitric acid, when the spores are in the oval state.

Fig. 5. Granules contained in the fluid of the theca; *a.* in the early state; *b.* lesser granules, remaining in the mature state.

Fig. 6. Spore and integument, detached by means of water, immediately after the separation of the cells.

Figg. 7 & 8. Progressive states of the integument, up to that in which the spiral sutures are formed.

Fig. 9. Form of the integument at the time of its separation.

Fig. 10. Integument, partially separated.

Fig. 11. End view of the integument, as at fig. 9, showing the transverse sutures, which bound the clavate ends of the filaments.

Fig. 12. Spore, with the integument separated into filaments, detached before maturity, to show the latter partially unrolled.

Fig. 13. Spore and outer tunic, after immersion in dilute tincture of iodine.

Fig. 14. Highly magnified portion of the theca; *a.* line of dehiscence; *b.* meshes in irregular rows or areolæ, in which spiral vessels are formed; *c.* muriform meshes, on which the vessels near the line of dehiscence incline to annular.

Figures 3, 5, 9, 10, 11, 12, 13 & 14, are magnified 400 diameters.

XXXIX. *On a Gall gathered in Cuba by* W. S. Macleay, *Esq., upon the Leaf of a Plant belonging to the Order* Ochnaceæ. *By the Rev.* M. J. Berkeley, *M.A., F.L.S.*

Read April 16th, 1839.

In following out any branch of natural history, the attentive student is constantly struck with the host of unexpected analogies which meet him on every side. He is not surprised to find a complicated network of relations, whether of analogy or affinity, in his own particular department, but though his knowledge out of that is but superficial, he is astonished at observing how many analogies present themselves, which at first, perhaps, he is inclined to think fanciful or scarcely worth notice, but their number and importance increase on him so fast, that at length he is forced to acknowledge the fact, that peculiarities of form, structure, colouring, &c. are represented by similar peculiarities in other apparently but little related orders.

It is most curious, for instance, to find the different organs of which the more perfect plants are composed represented by various minute Algæ and Fungi, a circumstance, to which, perhaps, is owing the great success which has attended the physiological researches of various close observers or students of Cryptogamic plants, as Link, Mirbel, Mohl, Meyen, &c., and which has caused Agardh*, in perhaps rather too exclusive terms, to call the attention of all inquirers into the more intimate structure of phænogamous plants to his own favourite department of science†.

* Agardh, *Organographie der Pflanzen*, p. 101, note.

† As an instance of this, the analogy between the helices of spiral vessels and the flocci or sporidia of *Helicomyces*, *Helicosporium* and *Helicotrichum*, pointed out by Kunze in his *Mycologische Hefte*, may be mentioned. It might be objected, that the articulations of the plants in question differ from anything in spiral vessels; but it is very curious that Meyen (*Neues Syst. Pflanz. Phys.* vol. i. tab. 4. fig. 8.) has lately discovered articulated helices in the cells of *Oncidium maximum*. Here an analogy recognized between the fungi in question and the helices of spiral vessels might, if considered attentively, have been an index of the probability of the existence of articulated helices in some phænogamous

So palpable are some analogies between various productions of Insects and Fungi, that many eggs, galls, &c. have been described by authors as true Fungi. The eggs of an *Hemerobius*, for instance, are Corda's *Crateromyces candidus. Hypoxylon ostraceum*, Bull. (*Sphæria ostracea*, Sow.) is the nidus of an insect, as I have myself ascertained, though I have not as yet been able to learn of what order. *Atractobolus ubiquitarius*, Tode, is the egg of some *Acarus*, of the genus *Raphignathus*, probably, or some allied genus. It is most remarkable, however, that Fries has lately found a real Fungus whose characters agree exactly with those laid down from the insect's egg. *Epichysium argenteum*, Tode, is, according to the great Swedish mycologist, certainly entomogenous. The same may be said of some *Ascophoræ*.

The eggs of *Crioceris Asparagi* are so exactly like *Acrospermum compressum*, that it is difficult to distinguish them without analysis. In examining moulds the mycologist is often puzzled by the apparent presence of sporangia, which on more close inspection turn out to be the eggs of some minute *Acari*.

Again, various galls assume the form of Fungi, so that specimens are often transmitted as such by young botanists. *Sclerotium fasciculatum*, Schumacher, Fl. Dan. tab. 1492, is a common gall on oak-leaves; *Calocera Lauri*, Brotero, a clavariæform production, is, I understand, caused by an insect. But none perhaps is more remarkable than the subject of the present memoir, which at once so closely resembles a Fungus, and differs, in its erumpent habit and operculum, so much from other galls, that (on a cursory inspection indeed) it was regarded as an epiphytous Fungus by some of our first botanists, and was not recognised as the work of an insect even by the great entomologist who gathered it in Cuba, where it appears to be abundant.

On the occasion of making me a most kind offer of collecting Fungi for my Herbarium, in Australia, Mr. MacLeay was so good as to transmit to me for examination a leaf studded with the productions in question.

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plants. It appears to have escaped observation that Kunze first pointed out the spiral structure of the flocci in *Trichiaceæ*. See Kz. *l. c.* vol. ii. p. 94. Klotzsch also made the same discovery in examining the Fungi of Sir W. J. Hooker's Herbarium in the year 1831.

The discovery of the exuviæ in some of them, in addition to a microscopic examination, placed it beyond all doubt that I had before me the production of an insect.

Twenty or more individuals are produced on the same leaf (in that before me twenty-three), the upper surface of which is furnished with a strong shining cuticle. As soon as the presence of the grub has caused the tissue immediately around it to swell, and to detach itself above and below, by a sort of concentration, from the cuticle, there is an evident attempt, as it enlarges, exactly as in *Æcidium cancellatum* and other allied epiphytal Fungi, to burst indifferently through either surface, but, apparently, it is in general unable to overcome the superior resistance of the upper cuticle, though that is somewhat raised and occasionally a little ruptured, and consequently forces its way through the hypophyllous cuticle, splitting it into a few subacute laciniæ.

Each gall is cylindrical, about a line long, and consists of two distinct substances, the outer of which is dark brown, and evidently a continuation of the inner substance of the leaf; the inner much paler, thinner, shining and horny, as is indeed the case in many galls. The apex is strongly umbilicate with the border, which is formed of the outer coat, slightly expanded, and furnished with a few shallow, obtuse, distinct crenulations. At the bottom of the umbilicus is a nipplelike operculum. The operculum is solid and formed of the outer coat, but is intimately connected with the top of the inner horny sac, which is very thin above, and thus forms a lid to it, which fits on exactly where the outer suddenly diverges from the inner coat, so that little resistance is offered to the egress of the insect, except that of the upper portion of the inner coat, which, as said above, is extremely thin, and, at the point where the operculum fits on, very brittle. There is sometimes a little punctiform depression at the top of the operculum, which is probably the scar of the puncture made by the ovipositor of the insect. Seventeen of the galls were already burst; and out of the remaining six, one only furnished an imperfect grub, and this being exceedingly light and dry, was unfortunately lost whilst the drawing was in progress. Several of the other galls had the remains of exuviæ, but too imperfect to furnish any information. I am not aware that there is any instance on record of a gall bursting through the cuticle; and the oper-

culum is very singular*: but on these points I am happy to give an extract from a letter of Mr. MacLeay, which appears to me extremely interesting.

"I have examined the production of the Ochnaceous leaf under the microscope, and am convinced with you that it is the work of an insect, but I have not been so successful as you in discovering this insect. On observing, however, the structure of the nidus, I conceive it to be much more analogous to that of some of the woody galls than to the cocoons figured by Curtis in the paper to which you have referred in the Zoological Transactions. The first cocoon figured as that of a *Melolonthidous* insect is that of a whole Lepidopterous genus very common in America and New Holland. I have plenty of specimens collected by myself. The second figured by Curtis, and which is so like a gall, is more new to me; but I know several Lepidopterous cocoons analogous to it which appear to be galls, or rather productions of the tree to which they are attached. I have bred the insects, however, frequently, and found that the substance of these pseudo-galls is not vegetable but animal: that is, the caterpillar composes them of a sort of mason-work of its excrement, coated inside and out with a varnished silk or silky varnish. I have little doubt that this is the composition of the cocoons figured by Curtis, but who was not aware of the fact from never having had an opportunity of investigating the œconomy of these insects in their native country. Cocoons necessarily have opercula, or at least a place more easy of exit than their general substance will allow. So has the production on the Ochnaceous leaf, but its structure is vegetable, and I am therefore inclined to consider it a true gall, although I know no other instance of a gall with an operculum. The question then is, whether the larva you found has feet or not; if it has, the larva is probably Lepidopterous, which would be very singular. If it has not, the larva is probably Hymenopterous, allied to the *Diplolepidæ*. Upon the whole I consider it to be a gall most likely made by an Hymenopterous insect."

* It is clear that the gall described and figured by Réaumur (*Mém. pour servir à l'Hist. Nat. des Insectes*, tom. iii. p. 448. pl. 39. figg. 1—4), quoted by Mr. Curtis in Trans. Zool. Soc. vol. i. p. 307, has not an operculum; for he distinctly says, that before it spins its cocoon it pierces a hole in the gall; and the figure indeed shows the same tolerably well.

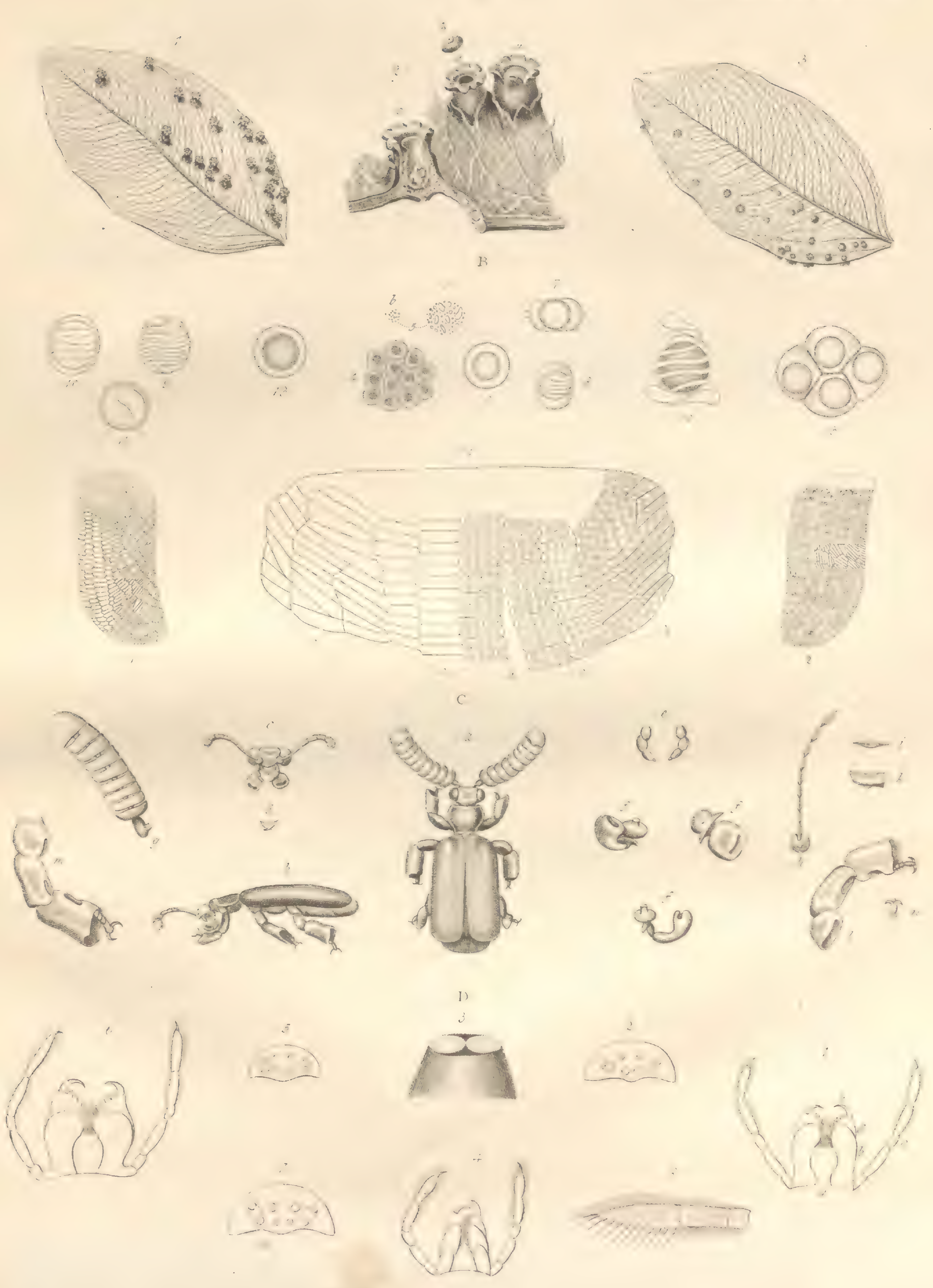
EXPLANATION OF THE FIGURES.

Tab. XXXIX. A.

Fig. 1. Under surface of the leaf of an Ochnaceous plant, with the galls of the natural size.

Fig. 2. Portion of the same magnified. *a a*. Galls. *b*. Operculum removed. *c*. Gall, cut vertically.

Fig. 3. Upper surface of the same leaf, showing the tendency of the galls to protrude through it also.


A
B
C
D

XL. *Synopsis of the Coleopterous Genus* Cerapterus. *By* JOHN O. WESTWOOD, *Esq., F.L.S., &c.*

Read June 16th, 1840.

THE discovery of a species in a hemisphere where the group to which it belongs has not hitherto been supposed to be indigenous, is always interesting, even if only considered with reference to the geographical distribution of the objects of nature. When, however, as in the case of the insect about to be brought before the notice of the Linnean Society, the species discovered belongs to a most anomalous tribe, and is itself one of the most anomalous of its tribe; and, moreover, when it is considered that the group is one which has received great attention on account of the rarity of the insects belonging to it, two monographs of them having appeared in the Transactions of the Society, I am sure I need offer no apology for submitting to the Society the present Synopsis.

The family *Paussidæ*, of which at the present time about forty-five distinct species are known, has hitherto been met with only in the Eastern hemisphere, the species being chiefly African or Asiatic; whilst New Holland has furnished two species, and the Balkan Mountains in Turkey another. Mr. Miers, whose botanical treasures have already so much occupied the attention of the Society, has been so fortunate as to bring home an insect of this family from South America belonging to the genus *Cerapterus*, but evidently possessing subgeneric characters distinct from those of the known species of that genus.

In my Monograph of this family I described three species of this genus: *C. latipes* and *C. MacLeaii*, which I knew only from the works of Swederus and Donovan, and *C. Horsfieldii*; having, however, no absolute means of determining whether the latter is distinct from *C. latipes*. In the second volume of the Transactions of the Entomological Society, I described another species from the collection of M. Gory of Paris, which, judging from the acknowledged inaccuracy of Donovan in minute points of organization, I then regarded, but

with doubt, as identical with *C. MacLeaii*. Mr. MacLeay himself, the possessor of the specimens described by Swederus and Donovan, having found a new species of the genus in Dr. Smith's African collection, published a Monograph of this genus in the first portion of the Annulosa of Dr. Smith's work, containing descriptions and figures of four species, namely, *Cerapterus latipes*, *Horsfieldii*, *Smithii* and *MacLeaii*, the last of which he separated as a distinct subgenus under the name of *Arthropterus*.

In a subsequent notice on this genus, rendered necessary by the publication of Mr. MacLeay's Monograph, I arranged the five species with which I was then acquainted in the following manner:

Subgenus 1. *Cerapterus propr.* *C. latipes*. Swed.; and *Horsfieldii*. Westw.
Subgenus 2. *Orthopterus*. Westw. *C. Smithii*. MacL.
Subgenus 3. *Arthropterus*. MacL. *C. MacLeaii*. Donov.
Subgenus 4. *Phymatopterus*. Westw. *C. piceus*. Westw.

In addition to the species from South America mentioned at the commencement of this paper, I have further become acquainted with two more new species of this curious genus, sent to me by Mr. Westermann of Copenhagen, the possessor of a splendid collection of insects, and to whom I am indebted for many valuable additions to my collection. As one of Mr. Westermann's species and that of Mr. Miers constitute two remarkably distinct subgenera, it will be serviceable to offer the following synopsis of this genus, now consisting of eight distinct species.

Subgenus 1. Cerapterus (strictè sic dictus).

Thorax latissimus, lateribus rotundatis. *Antennæ* latissimæ, lateribus serratis, articulo ultimo maximo. *Elytra* abdomen tegentia. *Tibiæ* latissimæ, spina nulla interna [in *C. 4-maculato* certè bicalcaratæ].

Species 1. Cerapterus latipes. *Swed.*

"C. piceus; elytris maculâ apicali flavescente subrotundâ anticè quadridentatâ posticè lobatâ; antennis rufis, articulo ultimo in tuberculo ad basin elevato." *MacLeay*. [Palpis labialibus securiformibus secundum figuras Swederi.]

Habitat in Oriente.

Species 2. CERAPTERUS HORSFIELDII.

C. piceus; thorace anticè emarginato, elytris maculâ apicali flavescente haud rotundatâ literam Y quodammodò simulante, palporum labialium articulo ultimo valdè securiformi.

Habitat in insulâ Java.

Obs. Exemplar alterum hujus speciei vidi in Mus. D. Melly triplò majus, vix tamen distinctum.

Species 3. CERAPTERUS QUADRIMACULATUS.

C. piceo-niger, nitidissimus: thorace (anticè viso) subemarginato maculis duabus magnis obscurè rufescentibus, elytris tenuissimè punctatis maculis duabus magnis ovalibus prope scutellum alterisque duabus apicem versus majoribus anticè et posticè lobatis rufo-fulvis.

Long. corp. lin. 5. Lat. elytr. lin. 2½.

Habitat in insulâ Java. In Mus. D. Westermanni.

Obs. Palpi labiales articulo ultimo mediocriter securiformi; tibiæque omnes distinctè bicalcaratæ (an etiam in *C. latipede* et *C. Horsfieldii*?).

Subgenus 2. ORTHOPTERUS. *Westw.*

Thorax latus (capite haud duplò latior). *Antennæ* longiores, sublatæ, planæ, lateribus subrectis, articulo ultimo mediocri. *Elytra* abdomen tegentia. *Tibiæ* spinâ apicali intùs instructæ.

Species 1. (4.) CERAPTERUS [ORTHOPTERUS] SMITHII. *MacLeay.*

C. nigro-piceus, subnitidus; elytris maculâ fulvâ notatis thorace latioribus et ferè quintuplò longioribus.

Habitat in Africâ Australi.

Subgenus 3. ARTHROPTERUS. *MacLeay.*

Caput thorace haud angustius. *Thorax* subquadratus, anticè paullò latior. *Antennæ* sublatæ, articulo ultimo mediocri. *Elytra* angusta, abdomine breviora. *Tibiæ* apice bicalcaratæ*, angulo opposito acutissimo.

* Mr. MacLeay has informed me since his arrival in New South Wales, in correction of the figure of *C. MacLeaii*, published by him, that it possesses two tibial spurs.

Species 1. (5.) CERAPTERUS [ARTHROPTERUS] MACLEAII. *Donov.*

C. rufo-brunneus; thorace subconvexo posticè angustiori, angulis anticis rotundatis, disco in medio vix canaliculato.

Habitat in Novâ Hollandiâ.

Subgenus 4. PHYMATOPTERUS. *Westw.*

Depressiusculus. *Caput* thorace angustius. *Thorax* cordato-truncatus, medio longitudinaliter impressus. *Antennæ* latæ. *Elytra* oblongo-quadrata, ad angulum externum apicalem tuberculo munita. *Tibiæ* latæ, internè ad apicem bicalcaratæ, angulo externo opposito rotundato. *Tarsi* distinctè 5-articulati.

Species 1. (6.) CERAPTERUS [PHYMATOPTERUS] PICEUS.

C. piceus, nitidus; antennis pedibusque rufo-piceis, punctis irregularibus minutissimis.

Habitat in Novâ Hollandiâ. In Mus. D. D. Gory et Curtis.

Syn. *Cerapterus MacLeaii.* Westw. in Trans. Ent. Soc. vol. ii. p. 25. pl. x. fig. 7.

Subgenus 5. HOMOPTERUS.

Depressiusculus. *Caput* thorace paullò latius, vertice depresso. *Palpi* maxillares parvi, graciles, articulo ultimo longiori attenuato; labiales 3-articulati, articulo 1mo minuto, 2ndo latiori brevi angulis apicalibus acutis, 3tio maximo valdè securiformi. *Antennæ* longiores, subplanæ, anticè subserratæ, margine postico ferè recto. *Thorax* cordato-truncatus. *Elytra* angustata, elongato-quadrata. *Femora* et tibiæ latissimæ, hæ apice ecalcaratæ, et pro receptione tarsorum excavatæ. *Tarsi* breves, articulis intermediis subtùs valdè setosis.

Species 1. (7.) CERAPTERUS [HOMOPTERUS] BRASILIENSIS. *Miers MSS.*

C. fulvo-rufescens tenuissimè punctatus; oculis albidis, vertice depresso, thorace intra angulos posticos utrinque foveolato. TAB. XXXIX. C. fig. *a* et *b*.

Long. corp. lin. $3\frac{1}{3}$. Lat. lin. $1\frac{1}{10}$.

Habitat in Brasiliâ prope Rio de Janeiro. In Mus. D. Miers.

Subgenus 6. Pleuropterus.

Caput thorace duplò angustius. *Antennæ* elongatæ subplanæ, articulo secundo extùs in angulum acutum producto. *Palpi* elongati; labiales articulo ultimo crassiori vix securiformi. *Labium* maximum, rigidum. *Thorax* elytrorum latitudine, lateribus margine elevato posticè valdè sinuato utrinque in auriculam producto. *Elytra* oblongo-quadrata, basi bicostata. *Pedes* elongati, graciles, tarsis latis subtùs setosis.

Species 1. (8.) Cerapterus [Pleuropterus] Westermanni.

C. rufo-piceus, haud nitidus; elytris nigris posticè cruce rufescenti notatis, basi bicostatis, disco longitudinalitèr subimpressis, apice rufescentibus.

Long. corp. lin. $4\frac{1}{3}$. Lat. lin. $1\frac{5}{6}$.

Habitat in insulâ Java. In Mus. D. Westermanni, cujus nomine hanc speciem admodùm singularem animo grato inscripsi.

EXPLANATION OF THE FIGURES.

Tab. XXXIX. C.

a. Cerapterus [*Homopterus*] *brasiliensis*, seen from above and magnified. *b.* Ditto, seen in profile. *c.* Head, seen from front. *d.* Mandibles. *e.* Maxillary palpi. *f f f.* Labial palpi, seen in different positions. *g.* Antenna, seen from above. *h.* Ditto, seen sideways. *i.* Transverse section of one of the joints of the antenna. *k.* One of ditto, seen from above. *l.* Fore-foot. *m.* Hind-foot. *n.* Tarsus.

XLI. *Descriptions of some Nondescript Insects from Assam, chiefly collected by* William Griffith, *Esq., F.L.S., Assistant-Surgeon in the Madras Medical Service, and attached to the late Scientific Mission to Assam. By the Rev.* Frederick William Hope, *M.A., F.R.S. & L.S.*

Read November 3rd, 1840.

DURING the last session, I submitted to the Linnean Society drawings and descriptions of some new insects collected in Assam, and which have since been published in the Transactions.

In consequence of my absence from London when the plates were engraved, the most remarkable form of the whole collection was omitted, partly as it did not well accord with the first plate, consisting entirely of Longicorn beetles, and partly as the figures would have appeared too crowded for the size of a quarto plate. At the suggestion of Mr. R. H. Solly, I have now figured that unique form under the name of *Cheirotonus*, and I have also given a few others; and in the course of the present paper it is my intention to describe the remaining nondescript species in Mr. Griffith's collection, and to add such remarks as may tend to throw additional light upon the entomology of a country almost yet untouched, but one which, from the magnitude and splendour of the insects already known, will be found to vie with, if not surpass, any others in the Old or even in the New World.

Lucanus. *Linnæus & Fabricius.*

Lucanidæ. *Leach.*

Lucanoidea*. *Hope.*

Spec. 1. Lucanus Forsteri.

Long. (mandibulis inclusis) unc. 2, lin. 11. Lat. elytr. lin. 10.

* In the Coleopterist's Manual the terms *Cicindeloidea* and *Caraboidea* are adopted to include the different families belonging to each of those groups; and the term *Lucanoidea* will comprise the *Lampridæ, Syndesidæ, Passalidæ*, &c., in short, all the natural families into which *Lucanus* of Linnæus has hitherto been subdivided.

Nigro-piceus; mandibulis valdè exsertis internè multidentatis ad basin dente valido suprà et infrà armatis, apicibus furcatis. Tab. XL. fig. 1.

Caput depressum, creberrimè punctulatum. *Thorax* convexus, subtilissimè punctatus, nitidus, lateribus extrorsùm serratis. *Elytra* piceo-castanea. *Pedes* concolores, tibiis mediis unidentatis, posticis inermibus.

I have named the above insect in honour of the venerable Treasurer of the Linnean Society, Edward Forster, Esq., a zealous promoter of Natural History in general, and distinguished for his accurate knowledge of the more difficult tribes of British Plants, and for his long and faithful services to this Society. I have received it previously from Assam: the specimens in Mr. Griffith's collection are small compared with the one figured, which is from Dr. Cantor's cabinet. It may be remarked respecting the *Lucanidæ* of the East Indies, that individuals of the same species are subject to vary very considerably in size, arising perhaps from scarcity or abundance of food whilst they are in the larva state, or perhaps in consequence of a want of sufficient moisture during seasons of drought. It seems necessary that a third section should be formed, to include those species of Stag-beetles which have five leaflets forming the club of the antennæ. Two other remarkable insects from the island of Java in my collection belong to the same section; they are provisionally named in my manuscripts as *L. falciger* and *L. longipennis*; and in a forthcoming synopsis of the species they will be found minutely described.

Spec. 2. Lucanus Rafflesii.

Long. unc. 2, lin. 6. Lat. lin. 8.

Niger, nitidus; mandibulis valdè exsertis ante apicem unidentatis, apicibus obtusis obliquè truncatis.

Caput latum, depressum, creberrimè punctulatum. *Thorax* capite paullò latior, marginibus undique elevatis, elytris nigris glabris, pedibus concoloribus.

Habitat in agro Assamensi variisque Indiæ Orientalis regionibus.

Affinis *L. nepalensi*, at major.

The above-described insect was originally named in my collection in honour of Sir Stamford Raffles: it appears to be widely spread over the Indian continent, as I have seen it in collections from Nepaul, Bengal and Assam; and,

if I am not mistaken in the species, there is a specimen in the Zoological Society's Museum, labelled as inhabiting Sumatra.

Spec. 3. Lucanus Spencii.

Long. unc. 1, lin. 9. Lat. lin. 6.

Ater; mandibulis exsertis basi robustis et unidentatis, apicibus furcatis.

Caput anticè depressum, posticè convexum, disco punctulatum. *Thorax* glaber, nitidus, sub lente subtilissimè punctatus, lateribus subserratis. *Elytra* a basi ad apicem gradatim attenuata, punctulis crebris per totum discum impressis. *Corpus* infrà nigrum, pedibus concoloribus, tibiis quatuor posterioribus medio unidentatis.

This insect was unique in the collection of Dr. Cantor: it is named in honour of Mr. Spence, the author of a valuable monograph on *Cholera*, published in the Linnean Transactions, and of other important entomological works.

Spec. 4. Lucanus curvidens.

Long. unc. 1, lin. 9. Lat. lin. 6½.

Niger; mandibulis exsertis intùs dente curvato valido ferè ad basin posito.

Caput valdè depressum, dentibus binis anticè prominentibus. *Thorax* glaber, margine undique elevato. *Elytra* nigro-picea, striato-punctata, internè subtilissimè punctulata, externè ad latera fortiter punctata et ferè scabrosa. *Corpus* infrà nigrum, pedibus concoloribus. *Tibiæ mediæ* unispinosæ; *posticæ* setosæ.

This remarkably depressed species of *Lucanus* was presented to me by Lady Jones; at present it may be considered as unique.

Spec. 5. Lucanus bulbosus.

Long. unc. 1, lin. 6. Lat. lin. 6.

Nigro-castaneus; mandibulis exsertis dentibus bulbosis armatis, apicibus acutis. Tab. XL. fig. 2.

Caput atrum, depressum, punctulatum. *Thorax* capite latior, castaneo-nigricanti inquinatus. *Elytra* concolora, thorace minora, ad apicem sensim

attenuata. *Corpus* infrà nigro-piceum, pectore rufescenti. *Pedes* femoribus rubro-corallinis, tibiis medio dente armatis, tarsis piceis, plantis infrà auricomis.

The above insect is named *bulbosus* from the heads of the teeth of the mandibles being rounded, a peculiarity I have not observed in any other of the *Lucanidæ*: it was taken by Dr. Cantor in Assam, and is found also in the Burmese territories.

Spec. 6. Lucanus astacoides.

Long. unc. 1, lin. 3. Lat. lin. 4.

Castaneus; antennis nigris, mandibulis exsertis intùs basi denticulatis denticulis nigricantibus, apicibus acutis.

Caput suprà castaneum, vertice bituberculato. *Thorax* concolor, utrinque nigro-punctatus, elytris capiteque latior, margine omni elevato. *Scutellum* nigrum. *Elytra* castanea, marginibus tenuissimis suturâque nigris. *Corpus* infrà rubro-piceum, pedibus concoloribus, tibiis quatuor posterioribus medio denticulatis tarsis chelisque nigris.

I have named the above species *astacoides*, as its mandibles resemble closely the claws of a lobster.

Spec. 7. Lucanus foveatus.

Long. unc. 2. Lat. lin. 6.

Castaneus; mandibulis valdè exsertis, apicibus acutis, dente ferè medio fortiori, aliisque 4 æqualibus ante apicem positis.

Caput atro-piceum, dentibus binis in vertice prominentibus, foveâ inter dentes fortitèr excavatâ. *Thorax* punctulatus, margine undique elevato. *Elytra* castanea, marginibus tenuissimis suturâque nigris. *Corpus* infrà rubro-piceum, femoribus rubro-corallinis, tibiis concoloribus et medio unidentatis tarsisque nigris. *Fœmina* adhuc mihi ignota.

The above species appears to be tolerably abundant in Assam, as there are several specimens in Mr. Griffith's collection; some of the individuals vary greatly in size, presenting also different shades of a light and dark mahogany colour. *Lucanus pallidipennis* and *L. confusus*, Hope, both from the island of Java, appear to be closely allied to the present species.

Spec. 8. Lucanus omissus.

Long. unc. 1, lin. 9. Lat. lin. 6.

Castaneus; mandibulis valdè exsertis, apicibus acutis, dentibus 2 nigris subbasalibus aliisque 4 subapicalibus.

Caput antennis nigris, dentibus binis in vertice valdè elevatis, foveâque inter dentes vix fortiter impressâ. *Mandibulæ* valdè exsertæ, apicibus acutis, dentibus binis nigris juxta basin quatuorque prope apicem positis. *Thorax* punctatus, margine omni elevato. *Elytra* castanea, marginibus tenuissimis suturâque nigris. *Corpus* infrà rubro-piceum, femoribus tibiisque concoloribus, tarsis nigris. *Fœmina* adhuc mihi incognita.

I have given the specific name of *omissus* to the above insect, as I at first imagined it to be the same as a Javanese species named in the French cabinets *castaneus*. On a closer examination it appears to be distinct, and is now described. I have received it from Dr. Cantor: it appears to be of rare occurrence.

Spec. 9. Lucanus serricollis.

Long. unc. 1, lin. 3. Lat. lin. 6.

Ater politus; mandibulis parùm exsertis sinuatis et punctatis.

Antennæ nigræ, articulis 6 ultimis cinerascentibus.

Caput anticè fortiter punctulatum, mandibulis parùm exsertis sinuatis et punctatis. *Thorax* convexus, anticè et posticè lineâ elevatâ insignitus, lateribus serratis. *Elytra* glabra, nitida. *Corpus* infrà nigrum, pedibus concoloribus. *Femora* parùm incrassata, tibiis valdè lineato-punctatis et unidentatis. *Tarsi* infrà luteo-comati.

The above insect appears to be the male of a hitherto unknown species of Stag-beetle; and it seems probable that when the female is discovered, it may form the type of a new genus; it belongs to the section which has five leaflets forming the club of the antennæ.

Spec. 10. Lucanus punctiger.

Long. lin. 9½. Lat. lin. 4.

Ater; corpore punctato nitido, thoracis marginibus externis serratis, elytris suturâ parùm elevatâ glabrâ insignitis, tibiis 4 posticis unidentatis.

Totum corpus suprà et infrà nigrum, nitidum, punctatum. *Caput* anticè rugoso-punctatum. *Thorax* marginibus externis serratis. *Elytra* striato-punctata, suturâ parùm elevatâ glabrâ insignita. *Pedes* subrugosi, tibiis quatuor posterioribus unidentatis.

The above insect appears to be the female of some hitherto unknown *Lucanus*; there is an immature variety of it with dark mahogany-coloured wings in Mr. Griffith's collection.

Having now described ten new species of *Lucanus* from Assam, I proceed to add some few observations respecting the group.

M. Latreille divided *Lucanus* into two, and Mr. W. Sharp MacLeay into five sub-families. The latter author also formed two sections of *Lucanus*, according as the club of the antenna consisted of three or four articulations; a third section ought to be added, when the leaflets of the club consist of five joints, with the addition of a spurlike joint succeeding them. Now as *Lucanus Forsteri* and five other species have the club consisting of five leaflets, there is ample ground for instituting a third section, which may therefore properly be denominated *Pentaphylla*. There can be little doubt that the above insect must eventually be formed into a distinct genus; but as at present I am merely describing species, I pass onwards to more material points. Thunberg, in his Monograph of *Lucanus*, published in the first volume of the Moscow Transactions, forms his three divisions from the characters of the mandibles; by which it appears, first, that they are furcate; secondly, simple, with the inner side dentated; and thirdly, simple and unarmed. Such are the leading characters adopted by authors in their subdivisions of *Lucanus*. It appears to me, however, that other points well worthy of attention have been neglected (some, indeed, I may say, almost entirely omitted); namely, those which relate to the absence or presence of armature on the tibiæ. I therefore here recommend them to notice.

A very remarkable *Lucanus*, obtained at Fernando Po by the gallant Captain Downes, and named after him in the Zoological Transactions, has all its tibiæ spineless. In *Lucanus Forsteri* the posterior tibiæ are unarmed, whilst the intermediate have one toothlike spine. In my *Lucanus pallidipennis* and in the *L. castaneus* of the French cabinets the four posterior tibiæ are unarmed. In *Lucanus nepalensis*, *Spencii*, *bulbosus* and *astacoides* (insects all differing considerably in form), the four posterior tibiæ are unidentate; and various other instances of the presence or absence of spines might be added: but as I think, in the instances above quoted, sufficient proof has been adduced of the variableness of tibial armature, a characteristic hitherto almost entirely neglected by entomologists, I pass on at present, hoping to enter more fully on these points when I publish my synopsis of the species of *Lucanoidea*.

It only remains to be added, that tropical India appears to be the metropolis of the *Lucanidæ*, more than fifty species from those regions having fallen under my inspection. The damage arising from the Stag-beetles even in Europe is often very considerable, as they perforate the solid wood in all directions, and in the East Indies the destruction occasioned by them must be much greater; but I am not aware of any instances on record of the injury there sustained from their attacks. The increase of species in the East is great, and the number of individuals of each species is oftentimes very surprising. It may here also be remarked, that the armature of most of the Indian species is strongly developed, and there can be little doubt that, as they are thus amply provided, it was wisely intended for the performance of those functions which are allotted to them; one of which, perhaps, is to keep in check the exuberant luxuriance of tropical vegetation. The *Lucani* of an Indian forest may be called the pioneers of its destruction: the rains during the monsoon enter the holes and excavations which they have made in the teak and other hard woods, and soon produce decay in the heart of the tree, when the white ants and other insects follow in their track, so that in a short time the proudest trees in the forest crumble into dust and disappear. It may here be added, before concluding these remarks, that the larvæ of the Stag-beetles are supposed by some authors, under the name of *Cossus*, to have afforded a delicious repast to the Roman epicure; and it seems not improbable that this

word, first used by Pliny, may be of Asiatic origin; but this point I willingly leave to others to decide, and proceed next to describe one of the most remarkable forms of Lamellicorn Beetles which has ever fallen under my notice.

Eucheiridæ. *Hope.*

Cheirotonus*.

Type of the genus *Cheirotonus MacLeaii.*

Generic Character.

Corpus oblongo-ovatum, crassum.

Caput subquadrangulare, clypeo subquadrato, lateribus subelevatis.

Antennæ 10-articulatæ, articulo 1mo et 7mo internè acutis, tribus ultimis clavam efformantibus.

Labrum transversum, anticè emarginatum, angulis lateralibus rotundatis, anticè densè et longè ciliatis.

Mandibulæ elongatæ, compressæ, inermes, internè valdè ciliatæ.

Maxillæ mandibulis longiores, apice longissimè ciliatæ, margine interno denticulato.

Palpi maxillares 4-articulati, articulis sensim magnitudine crescentibus, articulo ultimo oblongo-ovato, apice truncato.

Mentum elongatum, basin versùs angustatum, valdè setigerum, basi abruptè latiori, angulis anticis lateralibus rotundatis.

Labium breve, valdè emarginatum.

Palpi labiales 3-articulati, articulis duobus basalibus, ultimo majori subobovato.

Thorax elytris anticè angustior, lateribus subrotundatis valdè serrulatis, dorso fortiter punctato et in medio longitudinaliter impresso.

Elytra thorace latiora, convexa, nitida, lateribus ferè rectis.

Pedes robusti, armati, anticè longiores, tibiis irregulariter externè dentatis, tarsis elongatis, articulis apice spinâ brevi armatis, unguibus bidentatis setisque duabus in medio positis. *Tibiæ* 4 posteriores seriebus irregularibus spinarum armatæ.

* From χειροτονος, 'qui manibus extensis'.

Spec. 11. Cheirotonus MacLeaii.

Long. lin. 23. Lat. lin. 13.

Æneo-viridis; thorace lateribus externè serrulatis et varioloso-punctatis, sulco longitudinali in medio dorso fortiter impresso, elytris nigro-æneis maculis croceis insignitis, marginibus externè elevatis. Tab. XL. fig. 3.

Corpus infrà pilis longis obsitum, femoribus medio viridibus et glabris tibiisque valdè armatis.

The magnificent insect just described is named in honour of William Sharp MacLeay, Esq., author of *Horæ Entomologicæ*; and I have much pleasure in dedicating it to one who has so ably treated of the geography, manners and natural affinities of the insects which compose the Linnean genus *Scarabæus*.

Eucheiridæ, *mihi*.

The above family, according to my views, consists of the following genera:—

Genus.	Country.	Typical Species.
1. Eucheirus, *Kirby*	East Indies . .	longimanus, *Fabricius*.
2. Protomacrus, *Newman*. . .	Smyrna? . . .	bimucronatus, *Pallas*.
3. Cheirotonus, *Hope*	Assam . . .	MacLeaii, *Hope*.

The above three genera are all that are known at present; they are inhabitants of the Old World, and I do not know any from the New World corresponding with them, although an anonymous author, who has published an account of Venezuela, asserts that the *longimanus* of Fabricius is found in the last-mentioned locality; but from the description of the species, which is concisely given by the author, it is evident some other insect than *longimanus*, Fab. is alluded to, and I think it not improbable, therefore, that one of the *Golofa* or Sawyer Beetles, which abound in Venezuela, has been mistaken for the Fabrician insect. To the first of the above-mentioned genera the name of *Macropus* has been attributed, but as that term was previously used in other branches of zoology, and is still applied to the Kanguroo Beetle described by Dr. Shaw, Mr. Kirby has very properly substituted the name of *Eucheirus*.

The second insect is the type of the genus *Protomacrus* of Newman, and will be found refigured and redescribed in the fourth volume of the Entomological Magazine, at page 256, under the name of *Arbaces*; the name, however, of *bimucronatus*, originally given by Pallas, ought to be retained; and I must add, that I suspect there is some error respecting the locality of Smyrna, as Pallas in his *Icones Insectorum* expressly says respecting this species, that it is one particularly worthy of notice, and inhabits Amboyna; it is probable, therefore, that it might have been imported into Smyrna. With regard to *Cheirotonus*, I place it with the *Eucheiridæ*, which I consider as a family closely allied to the *Dynastidæ*, and forming a sort of connecting link with the *Goliathidæ*. Professor Klug and Dr. Burmeister consider *longimanus*, Fab. as belonging to the *Trichiidæ*. I own I differ from both authors; and as the anatomical sections of the mouth are now accurately figured, I willingly leave individuals to draw their own conclusions.

Spec. 12. Popillia gemma.

Long. corp. lin. $5\frac{1}{4}$.

P. angusta; capite prothorace scutelloque nitidis igneo-cupreis tenuissimè punctatis, elytris testaceis punctato-striatis, regione scutellari magis luteâ, podice cupreo maculis duabus albis è pilis brevibus formatis notato, antennis pedibusque testaceis his cupreo-nitentibus. Tab. XL. fig. 4.

Popillia gemma. Newman, Mag. Nat. Hist. vol. iii. p. 366.

Paracrusis.

Popilliæ affinis. *Corpus* breve ferè orbiculare gibbum. *Antennæ* 9-articulatæ. *Mandibulæ* corneæ, breves, apice fissæ, intùs lobo hirsuto notâque transversè striatâ basali instructæ. *Maxillæ* breves, apice 6-dentatæ, dentibus triplici serie dispositis 1, 2, 3. *Mentum* anticè emarginatum, tuberculo minuto centrali. *Palpi* breves, 3-articulati, scapo parvo inserti. *Clypeus* lineâ transversâ inter oculos a fronte separatus. *Prothoracis dorsum* transversum, margine postico curvato nec lobato. *Elytra* valdè convexa. *Pedes* breves, crassi, unguibus externis pedum 4 anteriorum bifidis, internis minoribus. *Prosternum* inter pedes anticos carinatum; *mesosternum* inerme.

Spec. 13. Paracrusis cyanipes.

Long. corp. lin. 6.

P. rubra, nitida; oculis nigris, antennis testaceis, capite nigro, elytris rubris glabris obsoletè 12-striato-punctatis, tibiis tarsisque cyaneis. Tab. XL. fig. 5.

Paracrusis cyanipes. Newman, Mag. Nat. Hist. vol. iii. p. 366.

Spec. 14. Lamia Swainsoni.

Long. unc. 1, lin. 4. Lat. lin. 6.

Brunnea; thorace utrinque spinoso, dorso convexo in medio bulboso, elytris concoloribus albo-variegatis ad basin nigro-tuberculatis. Tab. XL. fig. 6.

Caput lineâ inter oculos fortiter impressâ. *Antennæ* articulis quatuor ferrugineis, reliquis atris. *Thorax* utrinque spinosus, lateribus infrà pilis albis obsitis, anticè et posticè lineis binis transversis elevatis insignitus. *Elytra* thorace triplò longiora, lateribus rectis, apicibus bispinosis. Tubercula nigra ad basin, maculæque albæ seu cretaceæ per totum discum dispositæ. *Corpus* infrà brunneum, pectoris lateribus segmentisque utrinque cretaceo-maculatis pilosis. *Pedes* brunnei, geniculis nigris, tibiis quatuor posterioribus suprà pilosis, tarsis infrà spongiosis.

The above insect was purchased at the sale of Mr. Swainson's insects during the last summer, and is now named in honour of that zoologist; his publications on *Lepidoptera* are indispensable to the exotic entomologist, and of extreme value.

Lamia Swainsoni appears to form a subgenus allied to *Euoplia,* described in the first part of the Insects of Assam at page 37.

Spec. 15. Monachamus Beryllinus.

Long. lin. 8. Lat. lin. 3.

Cæruleo-beryllinus; antennis griseis, thorace utrinque spinoso elytrisque nigro-maculatis. Tab. XL. fig. 7.

Caput inter antennas fortiter sulcatum, posticè convexum. *Thorax* spinâ brevi

nigrâ utrinque armatus. *Elytra* basi scabra et nigro-tuberculata, humeris prominentibus, externè atris; lineis macularum quatuor per discum transversè currentibus; tuberculis aliis ante apicem. *Totum corpus* infrà cæruleo-beryllinum et pilosum, pedibus concoloribus, tarsis infrà solummodò brunneo-comatis.

The present insect is chiefly remarkable for its singular colour.

Saperdidæ.

Stibara.

Corpus saperdæforme, crassum, robustum.

Caput latum, anticè ferè quadratum, posticè convexum.

Antennæ corpore breviores, ante oculos insertæ, 11-articulatæ, articulo 1mo minimo brevi, reliquis gradatim magnitudine decrescentibus, apicibus acutis.

Thorax robustus, nodosus, haud spinosus.

Elytra lata, thorace haud triplò longiora, apicibus abruptè truncatis, lateribus elevatis.

Pedes femoribus incrassatis, tibiis robustis.

Spec. 16. Stibara tetraspilota.

Long. lin. 10. Lat. lin. 3½.

Aurantio-rubra; antennis oculisque nigris, thorace nodoso, elytris concoloribus, maculâ magnâ ovali nigrâ ad humeros positâ, apicibus nigris. Tab. XL. fig. 8.

Corpus infrà aurantium, sericie auratâ vestitum, femoribus tibiis concoloribus, tarsis suprà nigris, infrà flavo-spongiosis.

This insect is remarkable for its very robust form, from which peculiarity I have given it the above generic name. It appears closely allied to the *Lamia nigricornis* of Fabricius, found at Bombay and at Poonah; but instead of belonging to the *Lamiadæ*, it appears to be a subgenus closely approaching *Saperda*. There are also several other allied exotic genera belonging to the *Saperdidæ* which are at present undescribed.

Spec. 17. Stibara trilineata.

Long. lin. 9. Lat. lin. 3.

Pallidè castanea; antennis albo-cinctis, thorace nodoso utrinque denticulato, elytris lineis tribus nigris insignitis, suturâ latiori, lateribus punctatis, punctis duplici serie in medio disci fortissimè insculptis.

Totum corpus infrà flavo-tomentosum.

I have lately received the above insect from Courg through the kindness of Major Smith, and it is here added as forming a third species of the genus.

Spec. 18. Cheirochela Assamensis.

Tab. XL. fig. 9.

This remarkable insect has been previously described in the preceding part of the present volume at page 442, to which the reader is referred.

EXPLANATION OF TAB. XL.

Fig. 1. *Lucanus Forsteri*, Hope. 1*a*. One of the mandibles, seen sideways.

Fig. 2. *Lucanus bulbosus*, Hope.

Fig. 3. *Cheirotonus MacLeaii*, Hope. 3*a*. Labrum. 3*b*. Mandible. 3*c*. Maxilla. 3*d*. Mentum, labrum, and labial palpus. 3*e*. Antenna.

Fig. 4. *Popillia gemma*, Newm.

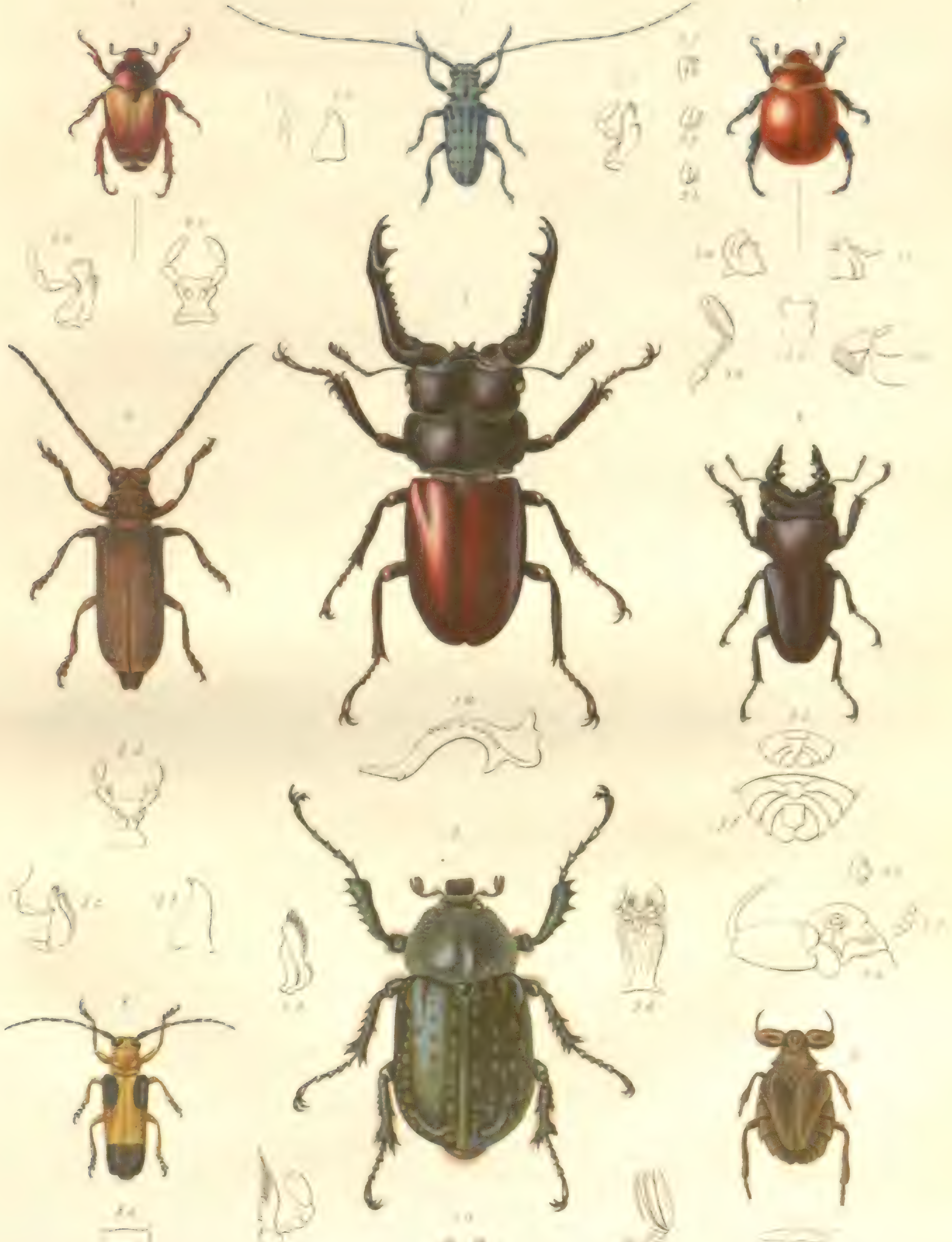
Fig. 5. *Paracrusis cyanipes*, Newm. 5*a*. Mandible. 5*b*. Maxilla. 5*c*. Mentum and labial palpus. 5*d*. Antenna. 5*e*. pro- and mesosternum. 5*f*. anterior; 5*g*. intermediate; and 5*h*. posterior ungues.

Fig. 6. *Lamia Swainsoni*, Hope. 6*a*. Maxilla. 6*b*. Mentum and labrum.

Fig. 7. *Monochamus beryllinus*, Hope. 7*a*. Mandible. 7*b*. Maxilla. 7*c*. Labial palpus.

Fig. 8. *Stibara tetraspilota*, Hope. 8*a*. Labrum. 8*b*. Mandible. 8*c*. Maxilla. 8*d*. Mentum, labium, and labial palpus.

Fig. 9. *Cheirochela Assamensis,* Hope. 9*a*. Underside of the head and fore-leg. 9*b*. Head, seen sideways. 9*c*. Rostrum. 9*d*. Antenna. 9*e*. Underside of extremity of body in some specimens. 9*f*. Underside of ditto in the other sex.



XLII. *The Difference in the Number of Eyes with which Spiders are provided proposed as the Basis of their Distribution into Tribes; with Descriptions of newly discovered Species, and the Characters of a new Family and three new Genera of Spiders.* By John Blackwall, *Esq., F.L.S.*

Read June 18th, 1839; and April 21st, 1840.

Messrs. Walckenaer and Dufour have separated the *Arachnida* constituting the order *Araneidea* into two principal divisions or groups, the former arachnologist having adopted a difference in the structure of the mandibles, and the latter a variation in the number of the branchial sacs of those animals, as the basis of their respective modes of distribution.

M. Walckenaer's first group consists of spiders whose mandibles are articulated horizontally, are prominent, and have a vertical movement; the species whose mandibles are articulated vertically, are not prominent, and have a lateral movement, composing his second group.

The characters supplied by the organic modification on which these groups are founded appear to be too slight, and of too little importance in a physiological point of view, to serve for the establishment of divisions of such magnitude; moreover, another objection to the value attached to these characters by M. Walckenaer arises from the circumstance of their merging gradually into each other, which prevents a clear line of demarcation being drawn between them.

An insuperable obstacle also presents itself to the adoption of M. Dufour's distribution of the *Araneidea* into spiders with four and spiders with two branchial sacs; it being impossible to determine, even on dissection, to which of the two groups numerous species belong. Indeed, that indefatigable and profound naturalist, M. Latreille, in attempting to arrange the *Araneidea* in accordance with M. Dufour's views, has fallen into the error of separating the *Ariadne insidiatrix* of M. Savigny (*Dysdera insidiatrix*, Walck.) from the

family *Dysderidæ*, to which it unquestionably appertains, and of placing it, together with *Segestria perfida* and *Segestria senoculata*, both species of considerable dimensions and provided with four branchial sacs, among the spiders of the second division, or those which have only two sacs*.

Having endeavoured succinctly to point out the insufficiency of the characters selected to distinguish the foregoing primary groups into which spiders have been divided, I venture to recommend the difference in the number of eyes with which those animals are provided as the most satisfactory basis of their distribution into tribes; supplying, as it does, well-defined characters not difficult to be ascertained, and being in perfect harmony with the leading principle on which the subordinate groups are, for the most part, established.

In the present limited state of our knowledge of the order *Araneidea* it admits of a division into three tribes only.

1. Octonoculina. Eyes eight.
2. Senoculina. Eyes six.
3. Binoculina. Eyes two.

The first tribe, *Octonoculina*, is much the most extensive of the three, comprising numerous genera, which present considerable differences in organization and œconomy: closely connected with this group by intimate relations of affinity and analogy, the second tribe, *Senoculina*, includes seven or eight genera, species belonging to most of which are indigenous to Great Britain; and the third tribe, *Binoculina*, contains the single genus *Nops*, which has been recently established by Mr. MacLeay for the reception of two remarkable species of extra-European spiders†.

The newly-discovered spiders described in the following pages are arranged according to the method proposed above; and it is a fact deserving of notice, that they have been captured, without exception, in the north of England and Wales.

Considering the narrow limits within which my researches in arachnology

* Cours d'Entomologie, p. 514–15.

† Annals of Natural History, vol. ii. p. 2, *et seq.*

have been made, and that I have had to depend almost entirely on my own resources, my success in this department of zoology has been greater than I could have anticipated. Much of this success must be attributed to the circumstance of having directed my attention more especially to species which, on account of their diminutive size, require for the accurate investigation of their internal structure the employment of optical instruments possessing a high degree of magnifying power.

In taking the dimensions of spiders, it is important that the relative length of the legs should be ascertained with accuracy. To facilitate this object, I submerge the specimens to be examined in spirit of wine till life is extinct; then removing them to a piece of white card-board, and carefully extending the limbs with a pin, while they are pliable, I take their extent, from the margin of the cephalo-thorax to their extremity, with a pair of compasses, which, on being applied to a scale of inches and parts, gives their measurement.

When exceedingly minute spiders are made the subjects of investigation, it is essential that the sexual organs should be closely inspected, as they afford, by their complete development, an infallible criterion that the animals have attained maturity; they also present, by their greatly diversified organization, particularly as regards the males, in which sex they are connected with the terminal joint of the palpi, excellent specific characters, the value of which will be duly appreciated when it is recollected that many species so nearly resemble each other in size and colour as to be distinguished by differences in structure only.

The principal authorities consulted in putting together the materials of which this paper is composed were MM. Latreille, Walckenaer, Hahn, and Koch.

Class Arachnida.

Order Araneidea.

Tribe Octonoculina.

Family Drassidæ.

Genus Clubiona, *Latr.*

1. *Clubiona brevipes.* Cephalo-thorace saturatè brunneo, anticè marginibus-

que saturatiore; mandibulis labioque nigrescentibus; maxillis sternoque saturatè rufescenti-brunneis; seriei anterioris oculis intermediis majoribus; pedibus brevibus pallidè luteis, pari 4to longissimo, dein 2do, 3tio brevissimo; abdomine saturatè rufescenti-brunneo, dimidii anterioris lineâ medianâ saturatiore.

Length of the female $\frac{1}{4}$th of an inch; length of cephalo-thorax $\frac{1}{10}$; breadth $\frac{1}{14}$; breadth of abdomen $\frac{1}{12}$; length of a posterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{6}$.

Upper part of the cephalo-thorax convex, glossy, thinly covered with hairs, broadly truncated before, with a narrow indentation in the medial line of the posterior region; its colour is dark brown, the anterior part and margins being much the darkest. Mandibles powerful, conical, convex at the base, in front rather prominent, armed with a few teeth on the inner surface, and of a very dark brown colour, approaching to black. Lip somewhat oval, truncated at the extremity, resembling the mandibles in colour. Maxillæ long, straight, enlarged where the palpi are inserted, and at the extremity, which is rounded. Sternum oval, glossy, with small eminences on the sides, opposite to the articulation of the legs; its colour, and that of the maxillæ, is dark reddish brown. Eyes disposed in two transverse, parallel rows on the fore-part of the cephalo-thorax; the anterior row, which is the shorter, is situated just above the frontal margin; the intermediate eyes form a trapezoid whose anterior side is the shortest, those of the anterior row being the largest of the eight. Legs short, of a pale dull yellowish hue; fourth pair the longest, then the second, third pair rather shorter than the first. Each tarsus is terminated by two curved, pectinated claws, below which is a small brush or climbing apparatus. Palpi short, with a small curved claw at their extremity; they resemble the legs in colour. Abdomen oviform, hairy, slightly depressed, projecting over the base of the cephalo-thorax; it is of a dark reddish brown hue, the medial line of the anterior half of the upper side being the darkest. Spinners prominent, very dark brown. Plates of the spiracles pale red-brown.

The male resembles the female in colour and in the relative length of its legs, but it is smaller than she is. Third and fourth joints of the palpi

short, the latter having a large apophysis at its anterior extremity, which tapers to a bifid termination curved in front of the fifth joint, a strong obtuse process occurring within the curve, near its base; fifth joint oval, convex and hairy externally, concave within, comprising the palpal or sexual organs, which are highly developed, complicated in structure, with a prominent, obtuse, corneous process near their extremity, and a curved, pointed spine, directed outwards, extending nearly to the termination of the joint; their colour is very dark brown.

This species usually occupies an oval cell of compact, white silk, which it spins on the inferior surface of leaves and of liverwort growing on trees in the wooded districts of Denbighshire and Caernarvonshire. It leaps with agility.

2. *Clubiona fucata.* Cephalo-thorace anticè rufescenti-, lateribus posticèque viridescenti-, lineâ marginali saturatè-brunneis; mandibulis maxillis labioque rufescenti-brunneis; sterno flavescenti-brunneo, lateribus rufescenti-brunneo maculatis; seriei anterioris oculis intermediis omnium minimis; pedibus flavescenti-brunneis, pari 4to longissimo, dein 2do, 1mo 3tioque ferè æqualibus; abdomine flavescenti-brunneo, anticè fasciâ medianâ, posticè maculis triangularibus, ad latera fasciâ interruptâ rufescenti-brunneis notato.

Length of the female $\frac{3}{16}$ths of an inch; length of cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{14}$; length of a posterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{6}$.

Cephalo-thorax oval, convex above, thinly covered with hairs, glossy, with a narrow indentation in the medial line of the posterior region; anterior part reddish brown; sides and posterior part greenish brown, with a fine, dark brown line on the margins. Mandibles powerful, conical, rather prominent. Maxillæ long, straight, enlarged where the palpi are inserted, and at the extremity, which is rounded. Lip longer than broad, nearly quadrangular. These parts are of a reddish brown colour. Sternum oval, glossy, with small eminences on the sides, opposite to the articulation of the legs; it is yellowish brown, with dark reddish brown spots on the margins. The eyes, which are seated on black spots, are disposed in two transverse, parallel rows on the fore-part of the cephalo-

thorax; the posterior row is longer than the anterior one, which is situated just above the frontal margin; the intermediate eyes form a trapezoid, whose anterior side is the shortest, those of the anterior row being the smallest of the eight. Legs provided with hairs and sessile spines, a longitudinal row of the latter occurring on each side of the inferior surface of the tibial and metatarsal joints of the first and second pairs; their colour is yellowish brown; fourth pair the longest, then the second, first and third pairs nearly equal in length. Each tarsus is terminated by two curved, pectinated claws, below which is a small climbing apparatus. Palpi short, with a small curved claw at their extremity; in colour they resemble the legs. Abdomen oviform, hairy, slightly depressed, projecting over the base of the cephalo-thorax; it is yellowish brown, with a dark reddish brown band above, extending nearly half its length from the anterior part along the middle, the interval between the posterior extremity of the band and the spinners being occupied by a series of triangular spots of the same hue; on each side of the medial line is an irregular, interrupted, longitudinal band of a dark reddish brown colour; margins of the sexual organs, and three narrow bands, situated between them and the spinners, dark reddish brown. Plates of the spiracles yellowish white.

The male resembles the female in colour. I have taken individuals of this sex in autumn which had the terminal joint of the palpi much enlarged, but they evidently had not attained maturity, as the palpal organs were not fully developed.

Woods in Denbighshire and Caernarvonshire are the haunts of this species, which, in summer, conceals itself among the foliage. I have captured females in the month of June whose abdomens were greatly distended with eggs.

Fam. CINIFLONIDÆ.

Filatoria 8; 2 inferiora inarticulata, usque ad apices coalita. *Pedum posteriorum metatarsus* calamistro munitus e seriebus 2 parallelis spinarum exiguarum densè approximatarum.

These peculiarities of structure, so strikingly characteristic, exercise a decided influence upon the œconomy of the *Ciniflonidæ*. The calamistra are

employed to curl certain lines proceeding from the spinners, observed to constitute the most remarkable character in the web of every spider comprised in this family, those supplied by the inferior pair being wrought into a delicate inflected band, which chiefly imparts to the snare its most important property, namely, that of adhesion*.

Crevices in rocks and walls, and the foliage of trees and shrubs, are the favourite haunts of the *Ciniflonidæ*, which, by their general organization and habits, should immediately follow the *Drassidæ* in the systematic arrangement of the *Araneidea*.

Gen. CINIFLO.

Oculi in seriebus 2 transversis; serie posteriori posticè convexâ; seriei anterioris et brevioris oculi intermedii recti, supra marginem frontalem positi, paulò majores; utriusque laterales in tuberculis positi. *Maxillæ* fortes, ad apicem dilatatæ rotundatæ paulòque labium versus declinatæ. *Labium* paulò longius quam latum, medio dilatatum, apice truncatum. *Pedes* robusti; pari 1mo longissimo, dein 4to (in ♀), 3tio brevissimo. *Tarsi* triunguiculati; unguibus 2 superioribus curvatis pectinatis, inferiore prope basin inflexo.

Ciniflo atrox. (*Clubiona atrox*, Latr. Gen. Crust. et Insect. t. 1. p. 93. Walck. Hist. Nat. des Insect. Apt. t. 1. p. 605. *Amaurobius atrox*, Koch, Uebers. des Arachn. Syst. p. 15.)

This is the only spider at present ascertained to belong to the genus *Ciniflo*; though, from what is stated by M. Walckenaer relative to the appearance of the web of *Clubiona ferox*, Faune Française, Aranéides, p. 152, it scarcely admits of a doubt that this species also is provided with eight spinners and with calamistra; to assign it a place, however, among the *Ciniflonidæ* before this point has been determined by observation would be premature.

I may remark, that the relative length of the legs is different in the sexes of *Ciniflo atrox*, the second pair being rather longer than the fourth in the male.

* For a description of the calamistrum and of the manner in which it is employed by the *Ciniflonidæ* in the fabrication of their webs, and for an account of the discovery of the fourth pair of spinners in spiders belonging to this family, see the Transactions of the Linnean Society, vol. xvi. p. 473, *et seq.*, and vol. xviii. p. 223.

Gen. Ergatis.

Oculi subæquales, in seriebus 2 transversis in anticâ cephalo-thoracis parte positi; seriei utriusque intermedii quadram referentes, laterales ferè contigui in tuberculis obliquè positi. *Maxillæ* mediocres, labium versus declinatæ, basi convexæ, apice rotundatæ, intùs plus quam extùs abruptè curvatæ. *Labium* subtriangulare. *Pedes* breves, mediocres; pari 1mo longissimo, dein 2do, 3tio brevissimo. *Tarsi* triunguiculati; unguibus 2 superioribus curvatis pectinatis, inferiore prope basin inflexo.

Ergatis benigna. (*Theridion benignum,* Walck. Hist. Nat. des Aran. livr. v. pl. 8. fig. 1. *Drassus parvulus,* Blackw. Research. in Zool. p. 337. *Dictynna benigna,* Koch, Die Arachniden, b. iii. p. 27. tab. 83. fig. 184—5.)

Ergatis latens. (*Dictynna latens,* Koch, Die Arachn. b. iii. p. 29. tab. 83. fig. 186.)

Ergatis viridissima. (*Drassus viridissimus,* Walck. Hist. Nat. des Insect. Apt. t. 1. p. 631.)

In addition to the above-named species, it is probable that the *Drassus flavescens* of Kummer might be included in the genus *Ergatis,* as it appears, from the description given of it by M. Walckenaer (*Histoire Naturelle des Insectes Aptères,* tome i. p. 632), to have a close relation of affinity with *Ergatis viridissima*; but it would be precipitate to place it among the *Ciniflonidæ* before it has been proved to possess the essential characters of that family.

When my attention was first directed to *Ergatis benigna,* in the autumn of 1832, I supposed it to be new to arachnologists, and described it in the London and Edinburgh Philosophical Magazine, vol. iii. p. 437—8, under the appellation of *Clubiona parvula.* Soon after, having had an opportunity of comparing this spider with specimens of *Ergatis viridissima* received from the continent, I transferred it to the genus *Drassus,* with the *Phytophilæ,* to which genus it appeared to be allied (Researches in Zoology, p. 337). At this period I was not aware of its specific identity with the *Theridion benignum* of M. Walckenaer, and I am quite unable to comprehend why so accomplished and discriminating an observer should still persist in separating it from the forms with which it is most intimately connected by its organization and œconomy.

In treating upon the *Phytophilæ* in the *Faune Française*, *Aranéides*, p. 181, M. Walckenaer remarks, "on ne peut se dissimuler, que ce petit groupe, dont les caractères ne sont pas assez tranchés pour former un genre, est d'une classification difficile et douteuse, et que, *Drasse* par ses organes les plus essentiels, il s'allie sous d'autres rapports aux *Clubiones* et aux *Théridions*."

The difficulty and uncertainty alluded to in the foregoing quotation no longer exist as regards those species known to be furnished with eight spinners and with calamistra, and the establishment of the genus *Ergatis* is proposed for their reception.

Family LYCOSIDÆ.

Genus LYCOSA, *Latr.*

3. *Lycosa rapax.* Cephalo-thorace magno, saturatè brunneo, fasciâ medianâ latâ lateralique obscuriore flavescenti-brunneis; mandibulis maxillis labio sternoque saturatè rufo-brunneis; pedibus robustis, rufescenti-brunneis, ad femora colore saturatiore maculatis; pari 4to longissimo, dein 1mo, 3tio brevissimo; abdomine fasciâ latâ medianâ flavescenti-brunneâ nigro-marginatâ, margine posticè interrupto et cum maculis parvis lateralibus vittas obliquas efformante.

Length of the female $\frac{3}{8}$ths of an inch; length of cephalo-thorax $\frac{1}{6}$; breadth $\frac{1}{8}$; breadth of abdomen $\frac{1}{7}$; length of a posterior leg $\frac{1}{2}$; length of a leg of the third pair $\frac{3}{8}$.

Cephalo-thorax large, hairy, compressed anteriorly; sides depressed, with slight furrows diverging from the upper part toward the margins, a narrow indentation occurring in the medial line of the posterior region; colour dark brown, with a broad, yellowish brown band extending along the middle, and an obscure one of the same hue above each lateral margin. Four eyes, much smaller than the rest, form a transverse row in front; the other four, situated on the sides and anterior part of the cephalo-thorax, describe a quadrilateral, the anterior ones of which are the largest of the eight. Mandibles powerful, conical, vertical, armed with a few teeth on the inner surface; they are of a dark brown colour, with a faint tinge of red near the base, in front. Maxillæ straight, enlarged and rounded at the extremity, of a reddish brown hue. Lip nearly

quadrate, rather broader at the base than at the extremity; it is dark brown, except the tip, which is reddish brown. Sternum heart-shaped, very dark brown, with a faint tinge of red in the middle. Legs robust, reddish brown, with blackish brown spots and streaks on the thighs; fourth pair the longest, then the first, third pair the shortest. Each tarsus is terminated by three claws; the two superior ones are curved and deeply pectinated, and the inferior one, which is short, is inflected near its base. The palpi resemble the legs in colour, and have a curved, pectinated claw at their extremity. Abdomen oviform, thickly covered with hairs, convex above, projecting over the base of the cephalo-thorax; a broad band of yellowish brown, which tapers to the spinners, occupies the middle of the upper part; anteriorly it comprises an oval mark of a deeper shade, whose margins are blackish; this mark extends nearly half the length of the abdomen, and its posterior extremity is pointed; the yellowish brown band has a black border broken into spots posteriorly, which form, with smaller confluent ones of the same hue, oblique lines extending down the sides, the ground of which is yellowish brown; under part yellowish brown, with three obscure, longitudinal, dark brown bands. Plates of the spiracles brown, with reddish inner margins. Sexual organs dark reddish brown; a straight process, enlarged and depressed at its posterior extremity, is situated in a groove in their medial line.

The male is smaller than the female; the relative length of its legs is the same, but it is darker coloured and more distinctly marked. Thighs and tibiæ of the first pair of legs, and thighs of the second pair, very dark brown, approaching to black. Palpi very dark brown; the second joint is densely covered on the under side with black hairs; third and fourth joints short, the latter rather the stronger; fifth joint oval, convex and hairy externally, concave within, except at the extremity, which is compact and pointed, comprising the sexual organs; they are highly developed, complicated in structure, with a strong, prominent, corneous process on the outer side, and are of a dark reddish brown colour.

This species pairs in May, and in June the female spins a globular cocoon of pale yellowish brown silk of a compact texture, measuring $\frac{5}{24}$ of an inch in diameter, in which she deposits 60 or 70 spherical eggs of a pale yellow colour,

not agglutinated together. The cocoon is connected with her spinners by short lines of silk, and the young, when they quit it, mount on the body of the mother. I have seen this spider, which frequents woods, pastures, and commons, and is nearly allied to *Lycosa vorax*, on the sea-shore, just above high water-mark, and on the summits of Broad Crag, Helvellyn, Snowdon, and Carnedd Llewelyn, the highest mountains in England and Wales.

4. *Lycosa obscura.* Saturatè brunnea; cephalo-thorace medio lateribusque mandibulis maxillis pedibus palpisque obscurè rufescentibus; abdomine obscurè rufescenti-brunneo maculato, anticè fasciculis 3 minutis pilorum flavescentium; pedum pari 4to longissimo, reliquis subæqualibus.

Length of the female $\frac{1}{5}$th of an inch; length of cephalo-thorax $\frac{1}{10}$; breadth $\frac{1}{14}$; breadth of abdomen $\frac{1}{12}$; length of a posterior leg $\frac{9}{24}$; length of a leg of the third pair $\frac{1}{4}$.

Anterior part of the cephalo-thorax compressed; sides depressed, marked with slight furrows diverging from the upper part to the margins; in the medial line of the posterior region there is a narrow indentation. Mandibles powerful, conical, armed with a few teeth on the inner surface, inclined towards the sternum, which is heart-shaped and thinly covered with whitish hairs. Maxillæ straight, enlarged and rounded at the extremity. Lip nearly quadrate, rather broader at the base than the extremity. These parts are very dark brown, the middle and sides of the cephalo-thorax, the maxillæ and mandibles, having a faint tinge of red. Four eyes, much smaller than the rest, form a transverse row in front; the other four, situated on the sides and anterior part of the cephalo-thorax, describe a quadrilateral, the anterior eyes of which are the largest of the eight. Legs and palpi dark brown, with a tinge of red. Fourth pair of legs the longest; the other three pairs equal in length, or very nearly so; the third pair extends further, and appears to be longer than the first and second pairs in consequence of being articulated to the broadest part of the cephalo-thorax. Each tarsus is ter-

minated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi have a small, curved, pectinated claw at their extremity. Abdomen oviform, thickly covered with hairs, convex above, projecting over the base of the cephalothorax; upper part dark brown, with three minute tufts of yellowish hairs before; under part hoary, or pale yellowish brown. Sexual organs glossy, of a very dark brown colour, faintly tinged with red; connected with their anterior part is a large, straight process directed backwards; it occupies a groove in the medial line, and is enlarged and depressed at its posterior extremity.

The male, though rather smaller than the female, resembles her in the relative length of its legs, and in colour. Third and fourth joints of the palpi short, the latter being the larger; fifth joint oval, convex and hairy externally, concave within, except at the extremity, which is compact and pointed, comprising the palpal organs; they are highly developed, complicated in structure, having a strong, pointed spine near the middle, directed downwards and outwards, and a fine, black, curved spine originating on the inner side, and passing obliquely under the former; their colour is reddish brown.

In the month of August, females of this species may be seen among short grass and heath in pastures and on commons in Denbighshire and Caernarvonshire, with their cocoons attached to their spinners. The cocoon is lenticular, measuring $\frac{1}{7}$th of an inch in diameter, and is composed of pale brown, or dull greenish brown silk, of a compact texture, surrounded by a narrow whitish zone of a lighter texture; it contains about 25 spherical, yellow eggs, which are not agglutinated together. The young, when they quit the cocoon, mount on the back of the mother.

On the 12th of September, 1838, a minute Ichneumon came out of a cocoon belonging to this species, which I had placed in a phial.

5. *Lycosa latitans.* Cephalo-thorace saturatè brunneo ad margines laterales pilis raris albis munito; mandibulis maxillis labio sternoque rufo-brunneis; pedibus flavescenti-brunneis, fasciis obscuris saturatioribus, pari 4to

longissimo, reliquis subæqualibus; abdomine saturatè olivaceo-brunneo, serie laterali macularum albarum pilisque numerosis marginalibus albis munito.

Length of the female $\frac{1}{5}$th of an inch; length of cephalo-thorax $\frac{1}{10}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{14}$; length of a posterior leg $\frac{7}{20}$; length of a leg of the third pair $\frac{1}{4}$.

Anterior part of the cephalo-thorax compressed; sides depressed, marked with furrows diverging from the upper part to the margins; in the medial line of the posterior region there is a narrow indentation; colour dark brown, a few white hairs occurring on the lateral margins. Mandibles powerful, conical, vertical, armed with a few teeth on the inner surface; they are brown, tinged with red. Maxillæ straight, enlarged and rounded at the extremity, similar in colour to the mandibles, but paler. Lip nearly quadrate, rather broader at the base than the extremity, dark brown, except the tip, which is reddish brown. Sternum heart-shaped, reddish brown, the margins being the darkest. Four eyes, much smaller than the rest, form a transverse row in front; the other four, situated on the sides and anterior part of the cephalo-thorax, describe a quadrilateral, the anterior eyes of which are the largest of the eight; lateral eyes of the frontal row rather smaller than the intermediate ones. Legs yellowish brown, with obscure bands of a darker hue; fourth pair the longest; the other three pairs equal in length, or very nearly so. Each tarsus is terminated by three claws: the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi resemble the legs in colour, and have a small, curved, pectinated claw at their extremity. Abdomen oviform, thickly covered with hairs, convex above, projecting over the base of the cephalo-thorax; it is dark brown, with a tinge of olive; a row of minute, white spots extends along each side of the medial line of the upper part, and numerous whitish hairs occur on the sides and under part. Sexual organs black and glossy. Plates of the spiracles pale dull yellow.

The male is rather smaller than the female, which it closely resembles in colour, and in the relative length of its legs. Palpi slender; fourth

joint longer than the third; fifth joint of an elongated oval form, convex and hairy externally, concave underneath, near the middle, comprising the palpal organs, which are moderately developed, not very complicated in structure, with a crescent-shaped process at the extremity, and are of a reddish brown colour.

In the months of May and June, females of this species, which appears to connect the terrestrial with the semiaquatic *Lycosæ*, may be found under stones in moist situations in the woods of Denbighshire, with their cocoons attached to their spinners. The cocoon is globular, measuring $\frac{1}{8}$th of an inch in diameter, and is composed of white silk of a compact texture, surrounded by a narrow zone of a slighter texture; it contains 40 or 50 spherical, yellow eggs, which are not agglutinated together.

6. *Lycosa Cambrica.* Maxillis labium versus inflexis, cum cephalo-thorace mandibulis sternoque nigrescentibus; cephalo-thorace magno, pilis raris flavescenti-brunneis, posticè et ad latera irregulariter albo-maculato; pedibus palpisque saturatè flavescenti-brunneis nigro fasciatis; abdomine flavescenti-brunneo, anticè fasciâ medianâ pallidiore obscurè nigro-marginatâ, margine albo-maculato, posticè utrinque serie macularum alternatim nigrarum et albarum ad filatoria confluente, maculis lineis obscuris nigris transversis angularibus in vertice albo-maculatis connexis.

Length of the female $\frac{2}{5}$ths of an inch; length of the cephalo-thorax $\frac{3}{16}$; breadth $\frac{3}{20}$; breadth of abdomen $\frac{1}{6}$; length of a posterior leg $\frac{11}{20}$; length of a leg of the third pair $\frac{3}{8}$.

Cephalo-thorax large, convex above, somewhat compressed before, with slight furrows on the sides, and a narrow indentation in the medial line of the posterior region; its colour is brownish black, but it is clad with yellowish brown hairs, which are densest on the anterior part, and the posterior part and sides are marked with white hairs disposed in irregular spots. Four eyes, much smaller than the rest, form a transverse row in front; the other four, situated on the sides and anterior part of the cephalo-thorax, describe a quadrilateral, the anterior ones of which are

the largest of the eight. Mandibles powerful, conical, vertical, with a few teeth and a fringe of long hairs on the inner surface. Maxillæ strong, curved towards the lip, enlarged at the extremity, which is obliquely truncated and fringed with hairs on the inner side. Lip nearly quadrate, rather broader at the base than the extremity. Sternum heart shaped. These parts are brownish black, the maxillæ having a tinge of red at the extremity, and the sternum being thinly covered with long black and short yellowish brown hairs. Legs and palpi dark yellowish brown, with black bands; the latter have a curved claw at their extremity. Fourth pair of legs the longest, then the first; third pair the shortest. Each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. Abdomen oviform, rather broader at the posterior than the anterior extremity, thickly covered with hairs, convex above, projecting over the base of the cephalo-thorax; the upper side is yellowish brown, a band of a paler hue extending from the anterior part, along the middle, more than a third of its length; this band has an obscure border of black, on which are several irregular white spots; a series of black and white spots, disposed alternately, commences near the extremity of the band, on each side of the medial line, and extends to the spinners, where the two meet; the black spots of both series are connected by obscure, black, angular lines, each comprising a white spot within its vertex; the sides are mottled with dull olive-brown, yellowish brown, and white; and the under part is yellowish brown. A compressed, hairy process, enlarged at its extremity, is connected with the anterior margin of the sexual organs.

The male is smaller than the female, and paler; but it resembles her in the general distribution of its colours, and in the relative length of its legs. Base of the thigh of each anterior leg black. The first and second joints of the palpi are dark brown; the third and fourth, which are short, are yellowish brown; and the fifth is dark reddish brown; this last joint is of an elongated oval form, convex and hairy externally, with a cavity near its base, on the under side, comprising the palpal organs;

they are but little developed, complicated in structure, and of a dark reddish brown colour.

Adult males and females of this handsome spider were taken in swampy ground in woods at Oakland, in May 1839. The decidedly curved form of the maxillæ, an approximation to which may be observed in *Lycosa campestris*, *Lycosa allodroma*, and some other species, has not been considered of sufficient importance to require its separation from the genus *Lycosa*, with the semi-aquatic species of which genus it is very closely allied by its general organization, habits, and colours.

Family SALTICIDÆ.

Genus SALTICUS, *Latr.*

7. *Salticus distinctus.* Cephalo-thorace saturatè brunneo, strigâ utrinque marginali albidâ, supernè pilis flavescenti-brunneis albisque intermixtis, strigâ medianâ albâ; mandibulis maxillis labioque triangulari acuto saturatè brunneis; pedibus pallidè rufescenti-brunneis colore saturatiore fasciatis, pari 4to longissimo, dein 3tio, 2do brevissimo; palpis brevibus, basi saturatè brunneis, apice albidis; abdomine brunneo-rufo albidoque tincto, anticè arcubus 2 concentricis obscuris, posticè lineis angularibus seriatis albidis, maculâ anali albâ.

Maris par pedum anterius tertio paulò longius; paribus 1mo et 2do cum femoribus 3tii 4tique saturatè brunneis.

Length of the female $\frac{1}{6}$th of an inch; length of cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{14}$; length of a posterior leg $\frac{3}{16}$; length of a leg of the second pair $\frac{1}{8}$.

Cephalo-thorax large, nearly quadrilateral, abruptly sloping in the posterior region, prominent in front, projecting beyond the mandibles; it is of a very dark brown colour, with a longitudinal streak of yellowish white immediately above each lateral margin; upper part covered with yellowish brown and yellowish white hairs intermixed, a short streak of the latter hue occurring in the middle, behind the posterior pair of eyes. Mandibles strong, vertical, armed with a few small teeth on the inner surface.

Maxillæ short, straight, greatly enlarged at the extremity. Lip triangular, pointed at the apex. These parts are of a dark brown colour, the extremities of the maxillæ and lip being much the palest. Eyes disposed in three rows, constituting three sides of a square, in the front and on the sides of the cephalo-thorax; the eyes of the anterior row are surrounded by red hairs, the intermediate ones being very large; the intermediate eye of each lateral row is remarkably small. Legs pale reddish brown, banded with dark brown; fourth pair the longest, then the third; second pair the shortest. Each tarsus is terminated by two long, curved, slightly pectinated claws, below which is a small climbing apparatus. Palpi short: first joint and base of the second dark brown, the remaining portion yellowish white; the fourth and fifth joints are abundantly supplied with long hairs, and are employed as brushes to clean the anterior eyes. Abdomen oviform, thickly covered with hairs on the upper part, projecting over the base of the cephalo-thorax; it is of a brown colour, mixed with red-brown and yellowish white; there are some whitish hairs in front, and a white spot occurs on the anus; in the middle of the anterior part are two small, obscure, yellowish white, concentric arcs of circles, to which succeeds a series of angular lines of the same hue, whose vertices are directed forwards; the first two lines of the series are the most extensive, the extremities of the second being reflected and in contact with the first: sides brown, blended with yellowish white; under part dark brown, with the exception of a broad, reddish brown band extending along the middle. Superior spinners dark brown, the others reddish brown. Plates of the spiracles pale brown.

The male greatly resembles the female, but is rather smaller and darker coloured; the relative length of its legs is also different, the first pair being a little longer than the third. The whole of the first and second pairs of legs, and the thighs of the third and fourth pairs, are of a very dark brown colour. Third and fourth joints of the palpi short; the latter, which is the smaller, projects from its extremity, on the outer side, a long, pointed apophysis curved abruptly at the end; fifth joint large,

oval, very dark brown, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, little complicated in structure, projecting upwards to the articulation of the third and fourth joints, and are of a dark brown colour.

Salticus distinctus is common in Denbighshire on stone walls, in the interstices of which the female spins a cell of compact white silk attached to the surface of the stones. In the month of July she constructs in this cell a lenticular cocoon measuring $\frac{1}{6}$th of an inch in diameter, in which she deposits about 16 spherical, pale yellow eggs, not agglutinated together. The young, even before they quit the cocoon, exhibit some of the marks most characteristic of the species.

Family AGELENIDÆ.

Genus CŒLOTES.

Oculi in seriebus 2 transversis parallelis rectis; seriei anterioris et brevioris intermedii supra marginem frontalem positi, paulò minores; utriusque laterales in tuberculis positi. Maxillæ fortes, labium versus curvatæ, ad palporum insertionem et ad apices obliquè truncatos intùs pilis fimbriatos dilatatæ. Labium paulò longius quam latum, lateribus curvatis, apice truncato. Pedes robusti, pari 4to longissimo, dein 1mo, 3tio brevissimo. Tarsi triunguiculati, unguibus 2 superioribus curvatis pectinatis, inferiore prope basin inflexo.

Cœlotes saxatilis. (*Drassus saxatilis*, Blackw. Research. in Zool. p. 332. *Amaurobius terrestris*, Koch, Die Arachn. b. vi. p. 45. tab. 192. fig. 463–4.)

A description of this spider was originally given in the London and Edinburgh Philosophical Magazine, vol. iii. p. 436–7, under the name of *Clubiona saxatilis*. Afterwards I was induced to remove it to the genus *Drassus* on account of the curvature of its maxillæ (Researches in Zoology, p. 332). Subsequent investigations, made with great care, have served to convince me that it belongs to the *Agelenidæ*, as it possesses several characteristics in common with the spiders of that family. The anterior part of the cephalo-thorax is compressed; the superior spinners are triarticulate, longer than the rest, and have the papillæ or spinning-tubes disposed on the under side of the terminal

joint; each inferior tarsal claw is provided with two pairs of fine teeth near the base; and the web constructed by this species is of a compact texture, having a tube connected with it, extending, usually, to the extremity of a cylindrical cavity in the earth, which is frequently excavated by the animal itself.

The distinctness of the genus *Cavator* will be immediately perceived on comparing the characters upon which it is founded with those of the other genera comprised in the family *Agelenidæ*.

Genus AGELENA, *Walck.*

8. *Agelena elegans.* Cephalo-thorace mandibulis maxillis palpis labio sterno pedibusque flavescenti-rufis, horum pari 4to longissimo, reliquis æquali-bus; oculis seriei anterioris intermediis omnium maximis; abdomine nigricante, serie medianâ linearum obscurarum angularium pallidiorum maculâque utrinque anticè ovali nigrâ.

Length of the female, not including the spinners, $\frac{1}{8}$th of an inch; length of cephalo-thorax $\frac{1}{16}$; breadth $\frac{1}{20}$; breadth of abdomen $\frac{1}{16}$; length of a posterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{7}$.

Anterior part of the cephalo-thorax compressed; sides depressed, marked with furrows diverging from the upper part to the margins; a row of bristles, directed forwards, extends along the medial line, and there is an indentation in the posterior region. Mandibles strong, conical, armed with a few very minute teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ short, gibbous at the base, and inclined towards the lip, which is nearly quadrate, being rather broader at the base than the extremity. Fourth pair of legs the longest, the other pairs equal in length. These parts and the palpi are glossy, and of a yellowish red colour, the base of the lip being the darkest. Each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi have a curved claw at their extremity. Eyes disposed on the anterior part of the cephalo-thorax, in two transverse, curved, nearly parallel rows, whose convexity is directed backwards; the intermediate

eyes of the anterior row are the largest of the eight. Abdomen short, broad, thickly covered with hairs, somewhat larger at the posterior than the anterior extremity, convex above, projecting over the base of the cephalo-thorax; it is of a very dark brown colour, approaching to black, the under part being the palest; along the middle of the upper part extends a series of very obscure, angular lines of a lighter hue, whose vertices are directed forwards; and on each side of the anterior part, near its union with the cephalo-thorax, there is a blackish spot of an oval form. Spinners yellowish red, arranged in a transverse row immediately below the anus; the exterior ones, which are the longest, are triarticulate, and have the papillæ or spinning-tubes disposed along the inferior surface of the terminal joint. Plates of the spiracles yellowish white.

The male is rather smaller than the female, which it resembles in colour, and in the relative length of its legs; the absolute length of the organs of progression, however, is greater, a posterior leg measuring $\frac{3}{16}$ths of an inch. The second joint of the palpi has a curved, pointed, yellowish red process on the under side, near the middle; third and fourth joints short; the former is much the larger, very gibbous above, and has a small, pointed, blackish apophysis near its extremity on the outer side; the latter has a strong, blackish apophysis at its extremity on the under side, which is directed upwards, its curved point being in contact with the small apophysis of the third joint; fifth joint oval, moderately convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, not very complicated in structure, vascular, surrounded by a filiform, black spine, and are flesh-coloured. The convex sides of the terminal joints of the palpi are directed from, and the palpal organs towards each other.

This species, which resembles *Textrix agilis* in the relative length of its legs, is found under stones in moist pastures near Llanrwst in Denbighshire. The males have the palpal organs completely developed in the month of August.

9. *Agelena prompta.* Cephalo-thorace brunneo; mandibulis maxillis labioque rufescenti-, sterno flavo-brunneis; oculis seriei anterioris intermediis omnium minimis; pedibus brunneis, pari 4to longissimo, dein 1mo, 3tio brevissimo; abdomine suprà saturatè brunneo, serie medianâ linearum flavescenti-brunneâ, lateribus pallidè flavescenti-brunneis.

Length of the female, not including the spinners, $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{34}$; breadth of abdomen $\frac{1}{24}$; length of a posterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{12}$.

Anterior part of the cephalo-thorax slightly compressed; sides depressed, marked with furrows diverging from the upper part to the margins; a row of long hairs, directed forwards, extends along the middle, and there is an indentation in the posterior region; it is of a brown colour, the anterior part, which is rounded and rather depressed, being the darkest. Eyes disposed on the fore-part of the cephalo-thorax in two transverse, curved, nearly parallel rows, whose convexity is directed backwards; the intermediate eyes of the anterior row are the smallest of the eight, and the lateral eyes, which are seated on a small eminence, and are nearly contiguous, are the largest. Mandibles strong, conical and vertical. Maxillæ short, gibbous at the base, round at the extremity, and inclined towards the lip, which is nearly quadrate, being rather broader at the base than the extremity. These organs are reddish brown. Sternum heart-shaped, of a yellowish brown colour. Legs and palpi brown. Fourth pair of legs the longest, then the first; third pair the shortest. Each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base, where there is a pair of fine teeth. Abdomen oviform, thinly covered with hairs, convex above, projecting over the base of the cephalo-thorax; upper part dark brown, with a series of strongly marked, yellowish brown, angular lines, whose vertices are directed forwards, extending along the middle; sides and under part pale yellowish brown, the latter having a band of a darker hue in the medial line. Superior spinners much longer than the rest, triarticulate, with the spinning-tubes arranged along the under side of the terminal joint; this joint is whitish, the remaining portion, and the other mam-

mulæ, being of a brown colour. Sexual organs dark red-brown. Plates of the spiracles whitish.

The male is rather smaller than the female, which it resembles in colour. In both sexes the relative length of the legs is the same, but their absolute length is greater in the male, a posterior one measuring $\frac{1}{8}$th of an inch. Third and fourth joints of the palpi short: there is a slender, curved process on the outer side of the upper part of the former; another, longer, slenderer at its extremity, and more curved, projecting from a prominence or apophysis at the outer side of the lower extremity of the latter; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, not very complicated in structure, prominent at the upper part, nearly encircled by a fine, black spine, and are of a pale red-brown colour.

Agelena prompta occurs under stones in the woods near Llanrwst in Denbighshire. The male has the palpal organs fully developed in October.

10. *Agelena montana.* Cephalo-thorace mandibulis maxillis labio sterno pedibus palpisque brunneis; abdomine nigricante, obscurè sed ad latera evidentiùs flavescenti-brunneo maculato.

Length of the female, not including the spinners, $\frac{1}{14}$th of an inch; length of cephalo-thorax $\frac{1}{26}$; breadth $\frac{1}{36}$; breadth of abdomen $\frac{1}{26}$; length of a posterior leg $\frac{1}{9}$; length of a leg of the third pair $\frac{1}{13}$.

Anterior part of the cephalo-thorax slightly compressed; sides depressed, marked with furrows diverging from the upper part to the margins; in the medial line of the posterior region there is a narrow indentation. Mandibles strong, conical, and inclined towards the sternum, which is heart-shaped. Maxillæ short, gibbous at the base, round at the extremity, and inclined towards the lip, which is nearly semicircular. These parts are brown, the lip being much the darkest. Legs and palpi brown, the joints being the palest. Posterior pair of legs the longest, then the first, which a little exceeds the second in length, third pair the shortest. Tarsi terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi have

a curved claw at their extremity. Eyes disposed on the fore-part of the cephalo-thorax in two transverse, curved, nearly parallel rows, whose convexity is directed backwards; the lateral eyes, which are seated on a small eminence, and are nearly contiguous, are the largest, and the intermediate ones of the anterior row the smallest of the eight. Abdomen short, broad, thickly covered with hairs, convex above, projecting over the base of the cephalo-thorax; it is of a dull blackish brown colour, interspersed with obscure, yellowish brown spots, which are most conspicuous on the sides; the under part is the palest. The spinners are arranged in a transverse row immediately below the anus; the exterior ones, which are much the longest, are triarticulate, and have the spinning-tubes disposed along the inferior surface of the terminal joint; second joint of all the spinners reddish brown, the other joints yellowish white. Sexual organs prominent. Plates of the spiracles whitish.

Females of this species were discovered in February 1837, under stones on Gallt y Rhyg, a mountain in Denbighshire, near Llanrwst.

11. *Agelena nava.* Saturatè brunnea ferè nigra.

Length of the female, not including the spinners, $\frac{1}{15}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{36}$; breadth of abdomen $\frac{1}{32}$; length of a posterior leg $\frac{1}{12}$; length of a leg of the third pair $\frac{1}{15}$.

Anterior part of the cephalo-thorax compressed; sides depressed, marked with furrows diverging from the upper part to the margins; a row of fine bristles, directed forwards, extends along the middle, and in the posterior region, which is depressed, there is an indentation. Mandibles strong, conical, vertical. Maxillæ short, convex at the base, round at the extremity, and inclined towards the lip, which is nearly quadrate, being rather broader at the base than the extremity. Sternum heart-shaped. These parts are glossy, and, with the legs and palpi, are of a dark brown colour, the margins of the cephalo-thorax and the base of the lip being much the darkest. Fourth pair of legs the longest, then the first, third pair the shortest. Tarsi terminated by two curved, pectinated claws. Eyes disposed on the fore-part of the cephalo-thorax in two transverse, curved

rows, whose convexity is directed backwards; the lateral eyes are the largest, and the intermediate ones of the anterior row the smallest of the eight. Abdomen soot-coloured, thickly covered with hairs, short, rather larger at the posterior than the anterior extremity, convex above, projecting a little over the base of the cephalo-thorax. Spinners brown; the superior pair, which is much longer than the rest, and triarticulate, has the spinning-tubes arranged along the inferior surface of the terminal joint. Sexual organs prominent, and dark reddish brown. Plates of the spiracles pale yellow.

About midsummer, individuals of this species may be seen on rails and gates in pastures near Llanrwst in considerable numbers, but they are all females. The only male which has come under my observation was found beneath a stone imbedded in earth, in the autumn of 1837. It bore a close resemblance to the other sex, but escaped from me before I had an opportunity of describing the structure of the palpal organs, which were completely developed.

12. *Agelena celans.* Cephalo-thorace saturatè brunneo lateribus fasciâque medianâ flavescenti-brunneis; oculis seriei anterioris intermediis omnium multò minimis; mandibulis maxillis labio pedibus palpisque rufo-brunneis; abdomine saturatè brunneo rufescenti et flavescenti tincto, fasciâ medianâ obscurâ dentatâ rufescenti-brunneâ.

Length of the female $\frac{1}{6}$th of an inch; length of cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{14}$; length of a posterior leg $\frac{5}{16}$; length of a leg of the third pair $\frac{5}{24}$.

Anterior part of the cephalo-thorax slightly compressed; sides depressed, marked with furrows diverging from the upper part to the margins; in the medial line of the posterior region there is a narrow indentation; it is hairy, and of a very dark brown colour, with yellowish brown lateral margins, and a band of the same hue extending along the middle. Eyes disposed on the fore-part of the cephalo-thorax in two transverse, curved, nearly parallel rows, whose convexity is directed backwards; the lateral eyes are the largest, and the intermediate ones of the anterior row much

the smallest of the eight. Mandibles strong, conical, vertical, armed with a few teeth on the inner surface. Maxillæ short, convex at the base, round at the extremity, and inclined towards the lip, which is nearly quadrate, being rather broader at the base than the extremity. These organs are brown, with a tinge of red, the base of the lip being much the darkest. Sternum short, heart-shaped, and of a yellowish brown colour. Legs and palpi brown, tinged with red; the thighs are the palest. Fourth pair of legs the longest, then the first, third pair the shortest; the tibiæ and metatarsal joints of the first and second pairs have a series of large, sessile spines on each side of the inferior part. Tarsi terminated by two curved, pectinated claws. The palpi have a small, curved claw at their extremity. Abdomen oviform, rather broader at the posterior than the anterior extremity, hairy, convex above, projecting over the base of the cephalo-thorax; the upper part is very dark brown, with reddish brown and scattered hairs of a yellowish brown colour intermixed; along the middle extends an obscure, dentated band of reddish brown; the under part is yellowish brown, with three faint, longitudinal lines of a darker hue. The superior spinners are short, and have the spinning-tubes disposed at their extremity. Plates of the spiracles pale yellow.

The male is smaller than the female, which it resembles in colour and in the relative length of its legs. Third and fourth joints of the palpi short, the latter having a straight, pointed apophysis at its extremity, on the outer side; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs: they are highly developed, rather complicated in structure, vascular, with a black, corneous process at the extremity, which is broad, depressed, and curved near the base, and abruptly recurved about the middle; their colour is red-brown.

Agelena celans frequents woods in the vicinity of Llanrwst, running nimbly upon the ground and concealing itself under stones. The male has the palpal organs fully developed in August. It is a scarce species.

Family THERIDIIDÆ.

Genus THERIDION, *Walck.*

13. *Theridion fuscum.* Saturatè rufescenti-brunneum, abdomine maculis obscuris saturatioribus; oculis in seriebus 2 transversis, intermediis trapezoidem anticè multo breviorem referentibus, seriei posterioris omnium maximis, anterioris minimis; pedibus robustis, pari 1mo longissimo, dein 4to, 3tio brevissimo; labio semicirculari.

Length of the female $\frac{1}{16}$th of an inch; length of the cephalo-thorax $\frac{1}{32}$; breadth $\frac{1}{36}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{16}$.

This spider is of a dark reddish brown colour, the abdomen being marked with obscure spots of a deeper shade. Cephalo-thorax glossy, compressed before, very convex immediately behind the eyes, depressed in the posterior region, with a large indentation in the medial line, and furrows on the sides. Eyes disposed on the fore-part of the cephalo-thorax in two transverse rows; the intermediate ones form a trapezoid whose anterior side is much the shortest, and those of each lateral pair are contiguous and placed obliquely; the posterior eyes of the trapezoid are the largest, and the anterior ones much the smallest of the eight. Mandibles small, conical, armed with a few teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ obliquely truncated at the extremity on the outer side, and inclined towards the lip, which is semicircular. Legs robust; first pair the longest, then the fourth, third pair the shortest. Tarsi terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi have a slender, curved claw at their extremity. Abdomen subglobose, somewhat depressed, thinly covered with hairs, glossy, projecting greatly over the base of the cephalo-thorax.

Females of this species were captured in November and December 1837, on rails and under stones in pastures near Llanrwst.

14. *Theridion albens.* Albidum; ovalibus 2 parvis obliquis e lineis tenuibus nigris efformatis prope abdominis medium; cephalo-thorace fasciâ obscurâ medianâ; oculis in anteriore cephalo-thoracis parte positis, intermediis quadram referentibus; labio triangulari acuto.

Length of the female $\frac{1}{6}$th of an inch; length of cephalo-thorax $\frac{1}{32}$; breadth $\frac{1}{36}$; breadth of abdomen $\frac{1}{32}$; length of an anterior leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{16}$.

Cephalo-thorax glossy, compressed before, convex above, with a slight indentation in the medial line of the posterior region. Mandibles small, conical, vertical. Maxillæ slender, obliquely truncated at the extremity, on the outer side, and inclined towards the lip, which is triangular, and pointed at the apex. Sternum heart-shaped. First pair of legs the longest, then the fourth, which a little exceeds the second in length, third pair the shortest. Tarsi terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi have a curved claw at their extremity. Abdomen thinly covered with hairs, very convex above, projecting greatly over the base of the cephalo-thorax. The general colour of this spider is whitish, but a small, oblique oval, formed by a fine, black line, occurs near the middle of the upper part of the abdomen, on each side of the medial line; the sexual organs also are black, and an obscure band of a darkish hue extends along the middle of the cephalo-thorax. Eyes seated on black spots on the anterior part of the cephalo-thorax; the four intermediate ones form a square; the other four are disposed in pairs on the sides of the square, the eyes constituting each pair being contiguous and placed obliquely on a slight protuberance.

The minute spider from which the foregoing description was made was discovered in July 1837, among strawberry plants growing in my father's garden at Hendre House, near Llanrwst.

15. *Theridion callens.* Cephalo-thorace pallidè flavescenti-brunneo, lateribus maculisque pluribus triangularibus quarum maximâ centrali nigris; oculis in anteriore cephalo-thoracis parte, intermediis quadram referentibus, seriei anterioris in tuberculo positis; mandibulis saturatè brunneis;

maxillis *rufo-brunneis*, extùs brunneo-maculatis; labio triangulari basi nigro apice rufo-brunneo; sterno pallidè rufo-brunneo, maculis irregularibus marginalibus nigricantibus; pedibus gracilibus, pallidè flavescenti-brunneis, fasciis numerosis saturatioribus; abdomine nigro, rufo alboque vario, prope medium tuberculis 2 anticè nigris posticè albescentibus.

Length of the female $\frac{1}{8}$th of an inch; length of cephalo-thorax $\frac{1}{16}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{7}$.

This interesting spider has the cephalo-thorax oval, glossy, very convex above, and abruptly sloping in the posterior region, where there is an indentation in the medial line; along the middle extends a row of fine, curved bristles, directed forwards; its colour is pale yellowish brown, the lateral margins, and a triangular spot in the centre, which projects a line from the middle of its base to the eyes, and has a narrow triangle at its apex, whose base terminates at the medial indentation, together with a small triangular spot immediately behind each lateral pair of eyes, being black. Eyes seated on black spots on the anterior part of the cephalo-thorax; the four intermediate ones form a square, the two in front being placed on a prominence; the lateral eyes are disposed in pairs on the sides of the square, those constituting each pair are contiguous and placed on a small protuberance. Mandibles powerful, conical, armed with a few minute teeth on the inner surface, rather inclined towards the sternum, and of a dark brown colour. Maxillæ red-brown, with a dark brown mark on the outer side; they are pointed at the extremity and encompass the lip, which is triangular, black at the base, and red-brown at the apex. Sternum oblong heart-shaped; it is of a pale red-brown colour, with large, irregular, brownish black marks on the margins. Legs long and slender; there is a row of curved spines on the anterior side of the tibial, metatarsal, and tarsal joints of the first and second pairs, those on the metatarsal joint being much the longest; both the legs and palpi are pale yellowish brown, with numerous dark brown bands. First pair of legs the longest, then the fourth, which a little exceeds the second in length, third pair the shortest. Tarsi terminated by three claws; the two supe-

rior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi have a curved, pectinated claw at their extremity. Abdomen very convex above, projecting over the base of the cephalo-thorax; it is thinly covered with long, coarse hairs, and is variegated with black, red, and white; on the upper part, rather nearer the anterior than the posterior extremity, are two tubercles, which are black in front, and pale yellowish white behind; the prevailing tint of the part before the tubercles is black, and of that behind them, which comprises two transverse, black streaks connected in the middle, red. Plates of the spiracles yellow. Sexual organs reddish brown; a small process connected with their anterior part is directed backwards, and on each side of its extremity is a minute, glossy convexity of a deeper shade.

Theridion callens, which has a close affinity to the *Theridion aphane* of Walckenaer, constructs a very remarkable cocoon of a balloon-shape, measuring about $\frac{1}{8}$th of an inch in diameter; it is composed of soft silk of a slight texture, and a pale brown colour, enclosed in a loose, irregular network of strong, dark red-brown silk; several of the lines composing this network are united near the apex of the cocoon, leaving intervals there through which the young spiders pass when they quit it, and, being agglutinated together throughout the remainder of their length, form a slender stem, varying from $\frac{1}{10}$th to $\frac{1}{4}$ of an inch in length, by which the cocoon is attached to the under surface of stones and fragments of rock, appearing by its figure and erect position like a small fungus or some minute production belonging to the vegetable kingdom. The eggs are very large, considering the small size of the spider, five or six in number, spherical, not agglutinated together, and are of a brown colour. I have not been able to procure an adult male of this species, which frequents woods in the west of Denbighshire.

Genus WALCKENAËRA*, *Blackw.*

16. *Walckenaëra punctata.* Cephalo-thorace sternoque punctatis cum man-

* For the characters of this genus, see the London and Edinburgh Philosophical Magazine and Journal of Science, vol. iii. pp. 105–6; and Researches in Zoology, pp. 314–15. Subsequently to the publication of these characters, M. Koch has constituted the genus *Micryphantes* with species belonging to the genus *Walckenaëra*. See his Uebersicht des Arachn. Syst. p. 11.

dibulis maxillis labioque saturatè brunneis; palpis pedibusque rufis, horum pari 1mo 4toque longissimis æqualibus, 3tio brevissimo; abdomine nitente nigro.

Length of the female $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{20}$; length of an anterior leg $\frac{1}{7}$; length of a leg of the third pair $\frac{1}{9}$.

Cephalo-thorax oval, convex above, glossy, prominent before, where the eyes are seated, with an indentation in the medial line of the posterior region; numerous strongly marked punctures occur on the margins, from which rows of punctures converge to the upper part. Mandibles conical, armed with a few teeth on the inner surface, and inclined towards the sternum, which is broad, heart-shaped, and thickly marked with punctures. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. These parts are very dark brown, the mandibles and maxillæ having a tinge of red. Legs and palpi red. The first and fourth pairs of legs, which are the longest, are equal in length, and the third pair is the shortest. Tarsi terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. Eyes of the lateral pairs the largest, and those of the intermediate pair of the anterior row much the smallest of the eight. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and black. Sexual organs rather prominent, and reddish brown. Plates of the spiracles dull yellow.

Females of this species were taken in May 1838, under stones in a moist pasture near Llanrwst.

17. *Walckenaëra turgida.* Cephalo-thorace mandibulis maxillis labio sternoque saturatè pedibus palpisque rufescenti-brunneis; abdomine brunneo saturatiùs marmorato.

In anteriori cephalo-thoracis parte maris protuberantia magna oculifera lateribus fortitèr dentatis; et ante utrumque oculum paris superioris protuberantia magna obtusa.

Length of the female $\frac{1}{13}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth

$\frac{1}{36}$; breadth of abdomen $\frac{1}{32}$; length of an anterior leg $\frac{1}{11}$; length of a leg of the third pair $\frac{1}{15}$.

Cephalo-thorax oval, convex above, glossy, slightly prominent behind the eyes, with a small indentation in the medial line of the posterior region: it is of a dark brown colour. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum; they are of a dark brown colour, slightly tinged with red. Maxillæ rather paler than the mandibles. Sternum broad, heart-shaped, and convex: it and the lip are of a dark brown hue. Legs and palpi reddish brown. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. Tarsi terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, and is of a brown colour, mottled with darker brown. Plates of the spiracles pale yellowish brown.

The male is darker coloured than the female, and has on the anterior part of the cephalo-thorax a strong prominence, deeply indented on the sides, on which the eyes are seated. Immediately before each eye of the superior pair is a large, obtuse protuberance. Fourth joint of the palpi rather larger than the third, projecting a strong apophysis in front, which is bifurcated, the inner process being longer and more pointed than the outer one; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, complicated in structure, prominent, with a fine, curved spine at the extremity, and are of a red-brown colour.

Specimens of *Walckenaëra turgida* were discovered in September and October 1836, under stones and blocks of wood in the plantations at Crumpsall Hall, near Manchester.

18. *Walckenaëra atra.* Nigra; mandibulis maxillis pedibus palpisque brunneis. Anterior cephalo-thoracis pars in mare elevata obtusa, indentatione utrinque oblongâ.

Length of the female $\frac{1}{14}$th of an inch; length of cephalo-thorax $\frac{1}{32}$; breadth

$\frac{1}{36}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{14}$; length of a leg of the third pair $\frac{1}{20}$.

Cephalo-thorax oval, glossy, depressed on the sides, which are marked with slight furrows diverging from the upper part towards the margins; in the medial line of the posterior region there is an indentation. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. First and fourth pairs of legs the longest, and equal in length, third pair the shortest. Anterior intermediate eyes the smallest of the eight. The tarsi of this spider, and of all the species belonging to the genus which have come under my observation, are terminated by three claws; the two superior ones curved and pectinated, and the inferior one inflected near its base. Abdomen thinly clad with hairs, glossy, convex above, projecting over the base of the cephalo-thorax. This species is black, with the exception of the mandibles, maxillæ, legs, and palpi, which are brown, the first two being much the darkest.

The male is rather smaller than the female, but resembles her in colour, and in the relative length of his legs. The anterior part of the cephalo-thorax, where the eyes are situated, is elevated, but obtuse, with an oblong indentation on each side, extending backwards from the lateral eyes. Third and fourth joints of the palpi short, the latter being much the stronger; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a very prominent, filiform, curved, black spine, enveloped in a delicate membrane, originating about the middle of the outer side, and a short, straight, pointed one at their extremity; they are of a reddish brown colour.

Both sexes of *Walckenaëra atra*, the males having the palpal organs fully developed, were found in May 1838, under stones in moist pastures near Llanrwst. The species probably comes near *Theridion acuminatum*, Wider, in Mus. Senk. i. p. 232. t. 15. f. 11.

19. *Walckenaëra hiëmalis.* Cephalo-thorace mandibulis maxillis labio ster-

noque nigricantibus; pedibus palpisque rufo-brunneis; abdomine nitente nigro.

Anterior cephalo-thoracis pars in mare prominens, indentatione utrinque magnâ.

Length of the female $\frac{1}{15}$th of an inch; length of cephalo-thorax $\frac{1}{27}$; breadth $\frac{1}{36}$; breadth of abdomen $\frac{1}{32}$; length of an anterior leg $\frac{1}{11}$; length of a leg of the third pair $\frac{1}{14}$.

Cephalo-thorax oval, convex above, glossy, rather prominent before, where the eyes are situated, depressed in the posterior region, with a small indentation in the medial line. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. These parts, with the maxillæ and lip, are brownish black, the mandibles and maxillæ being the palest. Legs and palpi red-brown. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and black. Sexual organs prominent. Plates of the spiracles brown.

The male is rather smaller than the female, and has the anterior part of the cephalo-thorax much more prominent, a large indentation occurring on the sides, behind each lateral pair of eyes. Relative length of the legs the same in both sexes, those of the male being the redder. Fourth joint of the palpi brown-black, much larger than the third joint, depressed, hairy externally, overlapping the base of the fifth joint, and having its extremity curved outwards; immediately above which, on the outer side, is a curved, pointed spine, with a projection at its base: fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, complicated in structure, and have several curved, pointed spines at their extremity; their colour is reddish brown.

Numerous individuals of this species were observed running actively on rails in meadows and pastures near Llanrwst in December 1836, and January 1837.

20. *Walckenaëra bifrons.* Mas saturatè brunneus; pedibus palpisque flavescenti-rufis; cephalo-thorace anticè protuberantiâ magnâ perpendiculari obtusâ longitudinaliter bilobâ.

Length of the male $\frac{1}{14}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{28}$; breadth of abdomen $\frac{1}{28}$; length of an anterior leg $\frac{1}{9}$; length of a leg of the third pair $\frac{1}{12}$.

On the anterior part of the cephalo-thorax, which is compressed, there is a large, perpendicular, obtuse eminence, divided into two lobes at the summit by a longitudinal furrow; the posterior region is depressed, and the frontal margin very prominent. Mandibles small, conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. These parts are dark brown, the lip and frontal eminence of the cephalo-thorax being the darkest. Legs and palpi yellowish red. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. Four eyes, situated on the anterior part of the frontal eminence, form a square; the two superior ones are seated on a minute tubercle, and the inferior ones are the smallest of the eight; the other four are disposed in pairs on the sides of the eminence, near the front, those of each pair being contiguous. The fourth joint of the palpi, which is much shorter than the third, projects a small, slightly curved apophysis from its anterior extremity, on the outer side; the fifth joint is oval, convex and hairy externally, with an indentation on the outer side of the upper part; it is concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a curved, black spine at the extremity, enveloped in a delicate membrane, and are of a reddish brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and dark brown. Plates of the spiracles dull yellow.

The spider described above was captured by T. Glover, Esq., of Smedley, near Manchester, in June 1838, among coarse herbage in Gwydir woods, near Bettws y Coed, Caernarvonshire.

21. *Walckenaëra bicolor.* Maris cephalo-thorace mandibulis maxillis labio sterno pedibus palpisque brunneis; abdomine nigricante; cephalo-thoracis parte anteriori prominente obtusâ utrinque indentatâ.

Length of the male $\frac{1}{16}$th of an inch; length of cephalo-thorax $\frac{1}{32}$; breadth $\frac{1}{36}$; breadth of abdomen $\frac{1}{32}$; length of an anterior leg $\frac{1}{11}$; length of a leg of the third pair $\frac{1}{16}$.

Cephalo-thorax oval, convex above, glossy, prominent, but obtuse, in front, with a slight indentation in the medial line of the posterior region, and another immediately behind each lateral pair of eyes. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. These parts, with the maxillæ, lip, legs, and palpi, are brown, the lip being the darkest, and the legs the lightest coloured. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. Third and fourth joints of the palpi short, the latter being much the stronger; fifth joint somewhat oval, having a projection on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a slender, corneous process at the superior part, directed upwards, a bold prominence on the inner side, and a fine, convoluted, filiform spine, enveloped in a delicate membrane, extending from the upper part of the extremity; their colour is red-brown. Abdomen oviform, thinly covered with hairs, convex above, projecting over the base of the cephalo-thorax; it is of a brownish black colour. Plates of the spiracles pale yellow.

Males of this species, with the palpal organs fully developed, were taken in July 1836, on rails near Llanrwst.

22. *Walckenaëra parva.* Brunnea, abdomine saturatiore; maris cephalo-thorace anticè parùm prominente utrinque indentato.

Length of the female $\frac{1}{16}$th of an inch; length of cephalo-thorax $\frac{1}{32}$; breadth $\frac{1}{48}$; breadth of abdomen $\frac{1}{40}$; length of an anterior leg $\frac{1}{15}$; length of a leg of the third pair $\frac{1}{20}$.

Cephalo-thorax oval, glossy, very convex behind the eyes, depressed in the

posterior region, with an exceedingly minute indentation in the medial line. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is heart-shaped and glossy. Maxillæ strong, and inclined towards the lip, which is semicircular and prominent at the extremity. These parts, with the legs and palpi, are brown, the mandibles, lip, and margins of the cephalo-thorax being the darkest. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and very dark brown, or brown black. Plates of the spiracles brown.

The male, though smaller than the female, resembles her in colour and in the relative length of his legs; but differs from her in having an indentation on each side of the anterior part of the cephalo-thorax, immediately behind the lateral eyes. The fourth joint of the palpi, which is rather shorter and stronger than the third joint, projects an acute, prominent apophysis from its extremity, in front; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs; they are moderately developed, not very complicated in structure, rather prominent, and of a red-brown colour.

Numerous specimens of this very minute spider were procured on rails near Llanrwst, in December 1836, and January 1837.

23. *Walckenaëra humilis.* Nigricans; pedibus palpisque rufo-brunneis. Maris pedes posteriores anterioribus paulo longiores; cephalo-thoracis pars anterior elevata truncata apice pilis plurimis brevibus instructa.

Length of the female $\frac{1}{16}$th of an inch; length of cephalo-thorax $\frac{1}{29}$; breadth $\frac{1}{32}$; breadth of abdomen $\frac{1}{30}$; length of an anterior leg $\frac{1}{12}$; length of a leg of the third pair $\frac{1}{14}$.

Upper part of the cephalo-thorax glossy, convex, particularly behind the eyes, depressed in the posterior region, with an indentation in the medial line. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad, heart-shaped, convex and glossy. These parts, with the maxillæ and lip, are brown-black, the mandibles

and maxillæ being the brownest. Legs and palpi red-brown. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. Abdomen oviform, thinly covered with hairs, convex above, projecting over the base of the cephalo-thorax; it is brownish black. Plates of the spiracles very dark brown.

The male is rather darker than the female, and the anterior part of the cephalo-thorax, which is elevated and truncated, has numerous short hairs on its summit. On this summit, also, the eyes are distributed in pairs: one pair, situated on its posterior part, forms with another, on its anterior margin, an elongated trapezoid, whose front side is considerably the shortest; the two other pairs are disposed on the lateral margins, the eyes constituting each being contiguous; the anterior eyes of the trapezoid are much the smallest of the eight. The sexes differ, likewise, in the relative length of their legs, the posterior ones of the male, which measure $\frac{1}{11}$th of an inch, exceeding the anterior ones a little in longitudinal extent. The palpi are dark-coloured; the second joint is clavate, and has a small, pointed apophysis on the inner side, at the base; third and fourth joints moderately long; the latter projects a large apophysis from its anterior extremity, which curves outwards and rather upwards in front of the fifth joint; it is somewhat enlarged at its termination, and has a pointed process on the outer side; a small, obtuse apophysis occurs, also, on the under side of the fourth joint; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, very prominent, with a strong, curved, black spine at the superior part, and a fine, convoluted one on the outer side, near the extremity, resembling in form the human ear, contiguous to which, on the under side, is a slightly curved, pointed, projecting process. The colour of these organs is red-brown.

Specimens of *Walckenaëra humilis* were discovered in October 1836, under slates, in the garden belonging to T. Warner, Esq., of Crumpsall Green, near Manchester; and others were observed afterwards on rails at Crumpsall Hall.

24. *Walckenaëra apicata.* Nigricans; maxillis rufescenti-brunneis; pedibus

rufo-brunneis, nisi in tibiis paris 1mi et 2di saturatè brunneis; pari 4to longissimo, dein 1mo, 3tio brevissimo.

Maris pars anterior cephalo-thoracis elevata transversè bipartita, segmento posteriori longiori obtuso, anterioris apice instructo tuberculo parvo conico prope cujus apicem anticè processus duo minuti sursùm curvati.

Length of the female $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{32}$; breadth of abdomen $\frac{1}{24}$; length of a posterior leg $\frac{1}{7}$; length of a leg of the third pair $\frac{1}{10}$.

Cephalo-thorax oval, glossy, gibbous above, with slight furrows on the sides, and a minute indentation in the medial line of the posterior region. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad, convex and heart-shaped. These parts, with the lip, are brownish black. Maxillæ reddish brown. Legs red-brown, with the exception of the tibiæ of the first and second pairs, which are dark brown; fourth pair rather the longest, then the first, third pair the shortest. Palpi dark brown. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and brownish black. Sexual organs rather prominent. Plates of the spiracles yellow.

The male resembles the female in colour and in the relative length of its legs. The fore part of the cephalo-thorax is elevated, and divided into two segments by a transverse groove in front; the posterior segment is the larger, and has a pair of eyes seated on its summit, which is obtuse and rounded; the anterior segment is surmounted by a small, conical eminence, near the apex of which, in front, are two minute processes curved upwards; at the base of this cone, immediately below the curved processes, the smallest pair of eyes is situated, the two lateral pairs being placed on the sides of the anterior segment. The fourth joint of the palpi is larger than the third, and consists of three parts; one in front, which is broad, and round at the extremity; a smaller one underneath, of a similar form; and a long, slender one on the inner side, which passes obliquely before the fifth joint: fifth joint somewhat oval, having a pro-

minent lobe on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a fine spine at their extremity, enveloped in a delicate membrane, and curved in a circular form; they are of a reddish brown colour.

Males and females of this species were found on rails near Llanrwst in November 1837, and May 1838.

25. *Walckenaëra pumila.* Cephalo-thorace mandibulis maxillis labio sternoque saturatè pedibus palpisque rufescenti-brunneis; pedum pari 4to paulò longiore, dein 1mo, 3tio brevissimo; abdomine nitente nigro.

Maris cephalo-thorax anticè elevatus obtusus utrinque indentatione instructus.

Length of the female $\frac{1}{13}$th of an inch; length of cephalo-thorax $\frac{1}{28}$; breadth $\frac{1}{36}$; breadth of abdomen $\frac{1}{28}$; length of a posterior leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{12}$.

Cephalo-thorax oval, glossy, depressed on the sides, which are marked with slight furrows diverging from the upper part to the margins, and having an indentation in the medial line of the posterior region. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. These parts are of a dark brown colour, the mandibles and maxillæ being the palest. The lateral eyes are the largest, and the anterior ones of the trapezoid the smallest of the eight. Legs and palpi reddish brown. Fourth pair of legs rather the longest, then the first, third pair the shortest. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly clad with hairs, glossy and black. Plates of the spiracles dull yellow.

The male is rather smaller than the female, but resembles her in colour and in the relative length of his legs. The anterior part of the cephalo-thorax is elevated, but obtuse, with an oblong indentation on each side, extending backwards from the lateral eyes. Fourth joint of the palpi shorter than the third; it is produced at the extremity, on the inner side,

and has a small, pointed apophysis in front; fifth joint of an irregular figure, having a long process or lobe on the inner side, and a bold prominence at the upper part, from which a ridge extends to its extremity; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a long, black, prominent, filiform spine, enveloped in a delicate membrane, curved from the upper part downwards to their extremity, where it is directed to the outer side; their colour is pale reddish brown.

This spider conceals itself under stones in moist pastures near Llanrwst. The male has the palpal organs developed in May.

26. *Walckenaëra picina.* Mas nigricans, nisi in pedibus rufo-brunneis; horum pari 4to 1mo paulò longiore; cephalo-thorace anticè elevato obtuso indentatione utrinque magnâ.

Length of the male $\frac{1}{14}$th of an inch; length of cephalo-thorax $\frac{1}{28}$; breadth $\frac{1}{32}$; breadth of abdomen $\frac{1}{30}$; length of a posterior leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{12}$.

Anterior part of the cephalo-thorax elevated, but obtuse, with a large indentation immediately behind each lateral pair of eyes; in the medial line of the posterior region there is a small indentation. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. These parts are glossy and brownish black, the mandibles and maxillæ being the palest. Legs red-brown; fourth pair rather the longest, then the first, third pair the shortest. One pair of eyes is placed on the anterior part of the summit of the frontal elevation of the cephalo-thorax; the eyes of another pair, situated lower, in front, and constituting the shortest side of a trapezoid, which they describe with the former, being the smallest of the eight; those of each lateral pair are contiguous. The palpi are brown; the fourth joint is much larger than the third, and has the upper part of its extremity greatly produced, and tapering to a point, which curves in front of the fifth joint, towards its outer side; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs; they are

highly developed, complicated in structure, with a curved, pointed, corneous spine at the extremity, and are of a reddish-brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly clad with hairs, glossy and brownish black. Plates of the spiracles brown.

A specimen of this species, captured in the neighbourhood of Manchester, was received from T. Glover, Esq., in June 1838; and in the following month another specimen was taken near Llanrwst. Both individuals were adult males.

27. *Walckenaëra nemoralis.* Maris cephalo-thorace mandibulis maxillis labio sterno pedibus palpisque brunneis; abdomine nigricante; cephalo-thorace anticè elevato obtuso transversè bipartito; pedum pari 4to 1mo longiore.

Length of the male $\frac{1}{16}$th of an inch; length of cephalo-thorax $\frac{1}{32}$; breadth $\frac{1}{46}$; breadth of abdomen $\frac{1}{32}$; length of a posterior leg $\frac{1}{13}$; length of a leg of the third pair $\frac{1}{17}$.

There is no indentation in the medial line of the posterior region of the cephalo-thorax; the anterior part is elevated, but obtuse, with a transverse groove in front, which divides it into two segments. One pair of eyes is situated on the upper segment, near its anterior margin, and the rest are seated on the lower segment, one pair being placed on each side, and the other in front; the eyes of the last pair are the smallest of the eight, and, with those on the upper segment, form a long trapezoid, whose shortest side is before. Mandibles conical, armed with teeth on the inner surface, and inclined towards the sternum, which is broad, convex and heart-shaped. These parts, with the maxillæ, lip, legs, and palpi, are brown, the legs being the palest, and the lip, anterior part of the cephalo-thorax, and terminal joint of the palpi the darkest. Fourth pair of legs the longest, then the first, third pair the shortest. The fourth joint of the palpi, which is shorter than the third, projects three apophyses from its extremity: the smallest is situated underneath, the largest in front, and the third, of intermediate size, on the outer side; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly

developed, complicated in structure, having a bold protuberance near the middle, and a short, fine, curved spine at the extremity; their colour is dark reddish brown. Abdomen oviform, rather broader at the posterior than the anterior extremity, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy and brownish black. Plates of the spiracles dull yellow.

In March 1837, adult males of this species were found under stones in the woods about Llanrwst.

Genus Neriëne*, *Blackw.*

28. *Neriëne munda.* Maris cephalo-thorace mandibulis maxillis labio sternoque rufescenti-brunneis; pedibus palpisque pallidè rufis; pedum pari 1mo 4toque reliquis longioribus æqualibus, 3tio brevissimo; abdomine nigricante.

Length of the male $\frac{1}{8}$th of an inch; length of cephalo-thorax $\frac{1}{18}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{20}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{8}$.

Cephalo-thorax oval, glossy, convex above, with a slight indentation in the medial line of the posterior region. Mandibles strong, conical, vertical, provided with teeth on the inner surface, and a small, conical prominence in front, near the extremity, on the inner side. Maxillæ powerful, greatly enlarged where the palpi are inserted, and inclined towards the lip, which is semicircular and prominent at the extremity. Sternum broad and heart-shaped. These parts are reddish brown, the mandibles and maxillæ being the reddest. Legs and palpi pale red, with the exception of the terminal joint of the latter, which is reddish brown. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. This spider, like the rest of the genus, has the tarsi terminated by three claws; the two superior ones curved and pectinated, and the inferior one inflected near its base. The intermediate eyes form a trapezoid, the anterior ones of which are the smallest of the eight. Third and fourth

* For the characters of the genus *Neriëne*, see the London and Edinburgh Philosophical Magazine and Journal of Science, vol. iii. p. 187–8; and Researches in Zoology, p. 362–3.

joints of the palpi short; the former is very strong and convex in front, and the latter projects three apophyses from its extremity; the largest is situated on the outer side, the next in size on the inner side, and the smallest underneath; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, and of a reddish brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy and brownish black. Plates of the spiracles yellowish white.

Males of this species, with the palpi fully developed, may be seen in May and June among grass and plants growing in the woods about Llanrwst.

29. *Neriëne errans.* Cephalo-thorace appendicibusque brunneis, nisi in pedibus palpisque pallidè rufo-brunneis; abdomine obscurè viridescenti-brunneo serie medianâ obscurâ linearum angularium flavescenti-brunneâ.

Length of the female $\frac{1}{9}$th of an inch; length of cephalo-thorax $\frac{1}{18}$; breadth $\frac{1}{28}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{3}{16}$; length of a leg of the third pair $\frac{1}{7}$.

Cephalo-thorax oval, convex above, glossy, with an indentation in the medial line of the posterior region. Mandibles powerful, conical, armed with teeth on the inner surface, and inclined towards the sternum, which is heart-shaped. Maxillæ strong, and inclined towards the lip, which is semicircular and prominent at the extremity. These parts are brown, the sternum being the palest, and the mandibles, maxillæ and lip having a tinge of red. Eyes small. Legs and palpi pale red-brown. First and fourth pairs of legs, which are the longest, equal in length, third pair the shortest. Abdomen oviform, rather convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, of a brownish colour faintly tinged with green, and has a series of obscure, angular lines, of a pale yellowish brown hue, whose vertices are directed forwards, extending along the middle of the upper part. Sexual organs dark red-brown. Plates of the spiracles dull yellowish brown.

The male resembles the female in colour and in the relative length of

his legs, but is rather smaller than she is. Third and fourth joints of the palpi short, the latter being much the stronger; fifth joint somewhat oval, with a large lobe on the outer side, near the upper part; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with several curved, pointed, prominent, corneous processes at the extremity, and of a red-brown colour.

Neriëne errans is of frequent occurrence on rails in the vicinity of Manchester, and of Llanrwst.

30. *Neriëne sylvatica.* Mas brunneus; abdomine nigricante.

Length of the male $\frac{1}{9}$th of an inch; length of cephalo-thorax $\frac{1}{16}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{7}$.

Anterior part of the cephalo-thorax, where the eyes are situated, rather prominent; sides marked with furrows diverging from the upper part to the margins; in the medial line of the posterior region there is a large indentation. Mandibles conical, provided with a few teeth on the inner surface, and a longitudinal row of exceedingly short, fine spines in front, on the outer side; they are inclined towards the sternum, which is broad and heart-shaped. Maxillæ very gibbous near the base, and inclined towards the lip, which is semicircular and prominent at the extremity. Legs slender. These parts are brown; the legs, which are the palest, and the mandibles, maxillæ and lip, which are the darkest, having a tinge of red. First and fourth pairs of legs the longest and equal in length, third pair the shortest. Eyes seated on black spots. The palpi resemble the legs in colour; the third and fourth joints are short, the former projecting a long bristle from its extremity, in front, and the latter, which is the stronger, being gibbous underneath, at the base; fifth joint somewhat oval, with a bold, conical protuberance at the upper part, in front, and a prominent lobe on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a strong, curved, obtuse, corneous process, slightly serrated on its external edge, situated on the outer side of the

upper part; another curved, corneous process, whose point is enveloped in a delicate membrane, extends from the upper part to the extremity of the fifth joint, and within its curvature a small, dentated spine occurs: their colour is red-brown. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and brownish black. Plates of the spiracles pale yellow.

Adult males of this species were taken in February 1837, under fragments of rock imbedded in earth in the woods about Llanrwst.

31. *Neriëne viaria.* Mas brunneus; abdomine nigricante; filatoriis pallidè flavescenti-brunneis.

Length of the male $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{3}{20}$; length of a leg of the third pair $\frac{1}{8}$.

Cephalo-thorax oval, moderately convex above, glossy, with slight furrows on the sides, and an indentation in the medial line of the posterior region. Mandibles powerful, conical, armed with teeth on the inner surface, rather divergent at the extremities, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. First and fourth pairs of legs the longest and equal in length, third pair the shortest. These parts are brown, the margins of the cephalo-thorax and the lip being the darkest, and the legs and maxillæ the palest. Intermediate eyes of the anterior row much the smallest of the eight. The palpi resemble the legs in colour; the third and fourth joints are short, the former, which is the stronger, having some long hairs projecting from its extremity, in front: the latter is gibbous underneath, at the base; fifth joint somewhat oval, with a large lobe on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, very prominent, and of a pale reddish brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and of a dark brown hue, approaching to black. Plates of the spiracles and spinners pale yellowish brown.

The spider from which the foregoing description was made was found running on a footpath at Oakland, near Llanrwst, in May 1838.

32. *Neriëne pulla.* Maris cephalo-thorace saturatè brunneo; mandibulis maxillis labioque saturatè rufo-brunneo; sterno brunneo, punctis saturatioribus; pedibus palpisque rufescenti-brunneis, nisi in horum articulo terminali saturatè brunneo; abdomine flavescenti-brunneo, punctis numerosis strigisque tenuibus saturatioribus.

Length of the male $\frac{1}{11}$th of an inch; length of cephalo-thorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{11}$.

Cephalo-thorax oval, convex above, glossy, with slight furrows on the sides, and an indentation in the medial line of the posterior region; its colour is dark brown. Mandibles strong, conical, armed with a few teeth on the inner surface, and inclined a little towards the sternum. Maxillæ powerful, and inclined towards the lip, which is quadrate. These parts are of a dark reddish brown colour. Sternum heart-shaped, glossy and brown, with very minute spots of a darker hue. Legs reddish brown; first and fourth pairs the longest and equal in length, third pair the shortest. Second joint of the palpi curved towards the cephalo-thorax; third and fourth joints short, the latter having a large process, rounded at the extremity, on the outer side, and a smaller one on the inner side; these joints are of a red-brown colour; fifth joint dark brown, oval, hairy and very convex externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, and red-brown. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly clad with hairs, and of a yellowish brown colour, with numerous minute spots and fine streaks of a darker hue. Plates of the spiracles pale yellow.

Males of this species, with the palpi fully developed, were taken in June 1836, on rails near Llanrwst.

33. *Neriëne gracilis.* Nigricans; pedibus pallidè rufescenti-brunneis; palpis saturatè viridibus.

Length of the female $\frac{1}{12}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{32}$; breadth of abdomen $\frac{1}{34}$; length of an anterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{12}$.

Cephalo-thorax oval, convex above, glossy, with an indentation in the medial line of the posterior region. Mandibles powerful, conical, armed with teeth on the inner surface, and inclined towards the sternum, which is heart-shaped. Maxillæ strong, and inclined towards the lip, which is semicircular and prominent at the extremity. These parts are brownish black. Legs slender, and of a pale reddish brown colour; first and fourth pairs the longest and equal in length, though, as in numerous other instances, the latter limbs do not extend so widely as the former, in consequence of being articulated nearer to each other, third pair the shortest. Palpi of a dark greenish colour. Abdomen slender, oviform, projecting a little over the base of the cephalo-thorax; it is thinly covered with hairs, and brownish black. Plates of the spiracles very dark brown.

The male resembles the female in colour, and in the relative length of his legs, but his mandibles and maxillæ are tinged with red, and the former have a small process in front, near the articulation of the nail. The second joint of the palpi has a row of hairs, directed forwards, extending along its upper part; third and fourth joints short; the latter, which is much the stronger, is slightly elongated in front, and has a small, pointed projection on the outer side, near its extremity; fifth joint somewhat oval, having on the upper part a bold prominence, indented on the outer side, and a curved, conical protuberance on the inner side; it is convex and hairy externally, concave within, comprising the palpal organs, which are prominent, highly developed, complicated in structure, and of a dark reddish brown colour.

Adults of both sexes were captured on rails at Capel Garmon, in Denbighshire, and at Crumpsall Hall, near Manchester, in the autumn of 1836.

34. *Neriëne parva.* Mas brunneus; abdomine saturatiore.

Length of the male $\frac{1}{20}$th of an inch; length of cephalo-thorax $\frac{1}{36}$; breadth $\frac{1}{40}$; breadth of abdomen $\frac{1}{40}$; length of an anterior leg $\frac{1}{13}$; length of a leg of the third pair $\frac{1}{16}$.

Anterior part of the cephalo-thorax slightly compressed; posterior part depressed, with an indentation in the medial line. Mandibles conical, armed with teeth on the inner surface and a tooth-like process in front, near the extremity; they are inclined towards the sternum, which is broad and heart-shaped. Maxillæ strong and inclined towards the lip, which is semicircular and prominent at the extremity. These parts, with the legs, are glossy and of a brown colour, the mandibles and lip being the darkest. First and fourth pairs of legs the longest and equal in length, third pair the shortest. The palpi are brown, the fourth joint being much the darkest; third and fourth joints short; the latter is produced, very prominent and pointed in front, with a large projection near its base, on the inner side; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a bold projection at the upper part, on the outer side, and one or two small, pointed ones at the extremity; they are of a red-brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy and dark brown. Plates of the spiracles pale yellow.

Males of this very small species, with their palpal organs completely developed, were discovered on rails at Oakland, near Llanrwst, in January 1837.

35. *Neriëne rubella.* Flavescenti-rufa; labio rufo-brunneo.

Maris pedes anteriores posterioribus longiores; paris 1mi et 2di tibiæ infrà prope apicem dilatatæ.

Length of the female $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{20}$; length of an anterior leg $\frac{3}{20}$; length of a leg of the third pair $\frac{1}{8}$.

Anterior part of the cephalo-thorax compressed and rather prominent; in the medial line of the posterior region there is an indentation. Mandibles robust, conical, armed with teeth on the inner surface and inclined towards the sternum, which is broad, convex and heart-shaped. These parts, with the maxillæ, are yellowish red, and the lip is red-brown. Legs and palpi pale yellowish red. First and fourth pairs of legs the

longest and equal in length, third pair the shortest. Eyes seated on black spots; the intermediate ones of the anterior row are much the smallest of the eight. Abdomen oviform, glossy, thinly covered with hairs, convex above, projecting over the base of the cephalo-thorax; its colour is yellowish red. Sexual organs black, faintly tinged with red. Plates of the spiracles dull yellow.

The male resembles the female in colour, but the anterior part of his cephalo-thorax is more prominent, and the relative length of his legs is different, the first pair being the longest, and the second and fourth pairs equal in length. The tibiæ of the first and second pairs of legs are somewhat dilated underneath, near their extremity, and these enlargements are thickly clad with long, fine hairs. Third joint of the palpi remarkably large, very prominent on the inner side, and provided with an acute apophysis in front, near the outer side; fourth joint crescent-shaped, the lower limb of the crescent being turned outwards, in front of the fifth joint, which is oval, convex and hairy externally, concave within, comprising the palpal organs; these organs are highly developed, complicated in structure, prominent, with two long, slender, curved, black spines on the under side, and are of a red-brown colour.

This species, which bears a strong resemblance to *Neriëne rubens*, occurs under stones and on plants growing in the woods at Oakland, near Llanrwst. The male has the palpal organs fully developed in October.

36. *Neriëne abnormis.* Cephalo-thorace appendicibusque rufescenti-brunneis; abdomine brunneo saturatiùs obscurè marmorato.

Maris cephalo-thorax pedesque multò magis rufi, abdomen saturatius, pedes anteriores posterioribus longiores.

Length of the female $\frac{1}{7}$th of an inch; length of cephalo-thorax $\frac{1}{14}$; breadth $\frac{1}{19}$; breadth of abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{3}{16}$.

Cephalo-thorax oval, convex above, glossy, with slight furrows on the sides, and an indentation in the medial line of the posterior region. Mandibles powerful, conical, convex in front, armed with teeth on the inner surface and inclined towards the sternum, which is heart-shaped. Maxillæ

robust and nearly straight, greatly resembling those of the *Linyphiæ.* Lip semicircular and prominent at the extremity. These parts are of a reddish brown colour, the sternum being rather the darkest, and the mandibles, maxillæ and lip the reddest. Eyes placed on black spots. Legs and palpi reddish brown; first and fourth pairs of legs the longest and equal in length, third pair the shortest. Abdomen oviform, thinly covered with hairs, convex above, projecting over the base of the cephalo-thorax; it is of a dull brown colour, obscurely mottled with darker brown. A depressed, oval, flesh-coloured protuberance is connected with the sexual organs. Plates of the spiracles yellowish white.

The male, which is rather smaller than the female, has the cephalo-thorax, legs, palpi, mandibles, maxillæ and lip red, with a slight tinge of brown; moreover, the abdomen is darker coloured than that of the female. The relative length of the legs, also, is different in the sexes, the male having the first pair longer than the fourth. Third and fourth joints of the palpi short, the latter being much the stronger and somewhat produced in front; fifth joint of an irregular, oval form, having a large lobe on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs, which are prominent, highly developed, complicated in structure, exhibiting several strong, corneous processes; one of which, situated at the extremity, is curved, pointed and enveloped in a semitransparent membrane, and a large one, at the upper part, projects two branches, one directed upwards, extending nearly to the articulation of the third and fourth joints, and the other directed downwards; both are pointed and curved outwards, an obtuse prominence occurring near the base of the latter, within the curve: these organs are of a reddish brown colour. The convex sides of the terminal joints are directed towards each other.

Adult specimens of this spider, which is very nearly allied to the *Linyphiæ* by the structure of the mouth and the disposition and relative size of the eyes, were discovered under stones at Crumpsall Hall, in October 1836.

37. *Neriëne variegata.* Cephalo-thorace flavescenti-brunneo, marginibus serie macularum parvarum utrinque guttâque triangulari pone oculos nigris;

mandibulis maxillis labio sterno palpisque flavescenti-brunneis; pedibus gracilibus flavescenti-brunneis nigro-fasciatis; abdomine sordidè luteo, fasciâ nigrâ medianâ in anteriori parte anticè triangulari posticè subramosâ, in series duas macularum parvarum ante filatoria coalitarum desinente.

Maris pedes anteriores posterioribus longiores.

Length of the female $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{32}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{3}{20}$; length of a leg of the third pair $\frac{1}{9}$.

Anterior part of the cephalo-thorax compressed; sides depressed and marked with furrows diverging from the upper part to the margins; in the medial line of the posterior region there is an indentation; colour yellowish brown, with blackish margins, a longitudinal row of small black spots on each side, and a black mark of a triangular form, whose vertex is directed backwards, immediately behind the eyes, which are seated on black spots. Mandibles long, powerful, divergent at the extremity, armed with a few teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. These parts, with the maxillæ, lip and palpi, are yellowish brown, the sternum and lip being the darkest. Legs slender, of a yellowish brown colour, with black bands; first and fourth pairs the longest and equal in length, third pair the shortest. Abdomen oviform, thinly covered with hairs, very convex above, projecting over the base of the cephalo-thorax; it is of a dull yellow colour, with a black band in the medial line of the upper part, extending from before rather more than a third of its length; the anterior portion of the band is triangular, with its vertex directed forwards; the posterior part is narrower and somewhat ramified; from the termination of the band extends a longitudinal row of irregular black spots, on each side of the medial line; a few of these spots unite immediately above the spinners, and form there short, curved, transverse lines; numerous streaks and patches of black occur on the sides, the largest of which are on their anterior part: the under part, and the plates of the spiracles, are dull yellowish brown. The sexual organs are prominent, and have a curved process in connection

with them, which is greatly enlarged at the extremity, and of a red-brown colour.

The male resembles the female in colour and design, but is rather smaller, and the absolute and relative lengths of his legs are different, the anterior legs, which exceed the posterior ones in longitudinal extent, measuring $\frac{1}{6}$th of an inch. Third and fourth joints of the palpi short; the latter is the stronger, and the former has a long bristle projecting from its extremity, in front; fifth joint somewhat oval, with a large lobe on the outer side, and a small projection at the upper part, which is notched at the extremity and curved outwards; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, and of a red-brown colour.

Both sexes of *Neriëne variegata* were obtained, in a state of maturity, in December 1837, under stones on Gallt y Rhyg, a mountain in the vicinity of Llanrwst.

38. *Neriëne dubia.* Maris cephalo-thorace appendicibusque rufo-brunneis; abdomine nigricante; pedibus anterioribus posterioribus paulò longioribus.

Length of the male $\frac{1}{12}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{30}$; breadth of abdomen $\frac{1}{28}$; length of an anterior leg $\frac{1}{9}$; length of a leg of the third pair $\frac{1}{14}$.

Cephalo-thorax oval, convex above, glossy, with a small indentation in the medial line of the posterior region. Mandibles conical, vertical, and armed with a few teeth on the inner surface. Maxillæ strong, gibbous near the base, enlarged at the extremity, and slightly inclined towards the lip, which is semicircular and prominent at the tip. Legs and palpi robust. First pair of legs rather the longest, then the fourth, third pair the shortest. These parts are of a red-brown colour, the legs being the palest. The intermediate eyes of both rows form nearly a square, the anterior pair being much the smallest of the eight. Second joint of the palpi curved towards the cephalo-thorax, and clavate; third and fourth joints short, the latter, which is the stronger, being produced and rounded

at the extremity, on the outer side, and slightly so on the inner side: fifth joint of an elongated oval form, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a fine, straight, prominent, pointed spine near the middle, and one or two slightly curved ones, enveloped in a semitransparent membrane, at the extremity; they are of a red-brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, and of a brown-black colour.

The male of this species, which makes a near approximation to the *Theridia* in external structure, was captured on iron rails at Crumpsall Hall, in October 1836. I have placed it, provisionally, in the genus *Neriëne*, till the female shall be discovered, as the sexes of the same spider frequently differ in the relative length of the legs and in the form of the maxillæ.

39. *Neriëne gibbosa.* Saturatè brunnea; pedibus palpisque flavescenti-brunneis; pedibus posterioribus anterioribus paulò longioribus.

Maris cephalo-thorax prope medium obtusè gibbosus, anticè fovea profunda pilis rigidis densè vestita.

Length of the female $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{20}$; breadth $\frac{1}{28}$; breadth of abdomen $\frac{1}{24}$; length of a posterior leg $\frac{1}{7}$; length of a leg of the third pair $\frac{1}{9}$.

Cephalo-thorax oval, glossy, rather gibbous near the middle, with slight furrows on the sides, diverging from the upper part towards the margins, and an indentation in the medial line of the posterior region. Mandibles strong, conical, armed with teeth on the inner surface and slightly inclined towards the sternum, which is broad and heart-shaped. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. These parts are dark brown, the mandibles and maxillæ being the palest. Legs and palpi yellowish brown. Fourth pair of legs rather the longest, then the first, third pair the shortest. Intermediate eyes of the anterior row the smallest of the eight. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy and very dark brown. Plates of the spiracles dull yellow.

The male is rather smaller than the female, but resembles her in colour and in the relative length of his legs. He has a large, obtuse prominence near the middle of the cephalo-thorax, between which and the anterior part, where the eyes are situated, there is a deep depression, thickly clad with strong hairs. The mandibles are provided with a small, conical protuberance in front, near their extremity. The fourth joint of the palpi, which is rather larger than the third, projects two minute, pointed apophyses from its extremity; one situated in front, and the other, which is the smaller, on the inner side; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs; they are neither highly developed, nor very complicated in structure, a dark reddish brown process, curved outwards, occurring at the upper part; their colour is yellowish brown, with a faint tinge of red.

Specimens of this remarkable spider, in a state of maturity, were discovered under stones in a moist pasture at Oakland, in May 1838.

40. *Neriëne tuberosa.* Mas saturatè brunneus; pedibus palpisque flavescenti-brunneis; cephalo-thorace prope medium gibboso; pedibus posterioribus anterioribus paulò longioribus.

Length of the male $\frac{1}{12}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{28}$; breadth of abdomen $\frac{1}{28}$; length of a posterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{12}$.

Cephalo-thorax oval, glossy, gibbous near the middle, with slight furrows on the sides, diverging from the upper part towards the margins, and an indentation in the medial line of the posterior region. Mandibles strong, conical, armed with teeth on the inner surface, and a small, conical protuberance in front, near the extremity; they are slightly inclined towards the sternum, which is broad and heart-shaped. Maxillæ inclined towards the lip, which is semicircular and prominent at the extremity. These parts are dark brown, the mandibles and maxillæ being the palest. Legs and palpi yellowish brown. Fourth pair of legs rather the longest, then the first, third pair the shortest. The intermediate eyes of the anterior row are the smallest of the eight. The fourth joint of the palpi, which is rather stronger than the third, projects two minute, pointed apophyses

from its extremity; one situated in front, and the other, which is the smaller, on the inner side; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs; they are moderately developed, complicated in structure, with a curved process at the upper part, directed outwards, and a small, black, pointed, curved spine at the extremity; their colour is red-brown. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy and very dark brown. Plates of the spiracles dull yellow.

The spider described above was found under a stone in a moist pasture at Oakland, in May 1838.

Genus Linyphia, *Latr.*

41. *Linyphia cauta.* Cephalo-thorace flavescenti-brunneo, marginibus lineâque medianâ anticè dilatatâ nigris; mandibulis maxillisque brunneis; labio sternoque nigricantibus; pedibus palpisque flavescenti-brunneis nigro-fasciatis; pedum pari 1mo longissimo, dein 2do, 3tio brevissimo; abdomine flavescenti-brunneo albo-punctato, anticè nigricanti-guttato posticè transversim lineato, lateribus nigricantibus fasciâ longitudinali medianâ flavescenti-brunneâ albo-maculatâ, maculis tribus confluentibus flavis rhomboidem efformantibus ad basin filatoriorum inferiorum.

Length of the female $\frac{5}{24}$ths of an inch; length of cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{10}$; length of an anterior leg $\frac{7}{16}$; length of a leg of the third pair $\frac{1}{4}$.

The anterior part of the cephalo-thorax, on which are distributed some long hairs directed forwards, is compressed; and in the medial line of the posterior region there is a large indentation; it is of a yellowish brown colour, with black margins, and a band of the same hue extending along the middle, whose anterior extremity is greatly enlarged. The eyes, which are seated on black spots, are arranged in two transverse rows on the fore part of the cephalo-thorax; the intermediate ones form a trapezoid, whose anterior side is the shortest; the other four are disposed in pairs on the sides of the trapezoid, the eyes constituting each pair being placed obliquely on an eminence, and almost contiguous; the posterior

eyes of the trapezoid are much the largest, and the anterior ones, which are placed on an eminence, the smallest of the eight. Mandibles powerful, conical, armed with two rows of teeth on the inner surface, and inclined towards the sternum, which is heart-shaped, glossy, and thinly covered with long, erect hairs. Maxillæ strong, straight, and somewhat quadrate. Lip semicircular and prominent at the extremity. The mandibles and maxillæ are brown, with a faint tinge of red, and the sternum and lip brownish black, the latter being dark brown at the tip. Legs and palpi long, and of a yellowish brown colour, with brownish black bands. First pair of legs the longest, then the second, third pair the shortest. Each tarsus in this, as in the other species of *Linyphia*, is terminated by three claws; the two superior ones curved and pectinated, and the inferior one inflected near its insertion. The palpi have at their extremity a long, slightly curved claw, minutely dentated more than half its length from the base. Abdomen thinly covered with hairs, very convex above, projecting over the base of the cephalo-thorax; it is of a yellowish brown colour, freckled with small, whitish spots, which are fewer in number and more minute on the under side; on the anterior part of the upper side are large, brownish black blotches, and on the posterior part numerous transverse, curved lines of the same hue, whose convexities are directed forwards; the sides are brownish black, with an irregular, longitudinal band of yellowish brown, spotted with white, extending along the middle. The spinners are brown, and at the base of the inferior pair are three confluent, yellow spots, forming a rhomboid. A small, cylindrical, semitransparent process is connected with the anterior part of the sexual organs, within the external orifice. Plates of the spiracles pale yellow.

The male bears a strong resemblance to the female, but is rather smaller and darker coloured than she is; the anterior part of the cephalo-thorax also, on which the eyes are seated, is more elevated. The relative length of the legs is the same in both sexes, but their absolute length is greater in the male, an anterior one measuring $\frac{17}{24}$ths of an inch. Third and fourth joints of the palpi short, the former having a long bristle projecting from its extremity, in front; the latter, which is the larger, is of

an oval form, and greatly elongated before, overlapping the base of the fifth joint, which is somewhat oval, with a bold, pointed projection at the superior part, on the inner side, and a prominent lobe on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs; they are depressed, very highly developed, and remarkably complicated in structure, having a strong, curved, corneous process on the outer side of the superior part, which has an obtuse protuberance on its upper side, and a pair of exceedingly long, filiform, black spines of unequal thickness, enveloped in a transparent membrane, curved twice into a circle measuring about $\frac{1}{16}$th of an inch in diameter. These organs are of a red-brown colour.

This spider spins an extensive, delicate, horizontal sheet of web, supported above by fine lines connected with it and with each other at various angles, in the corners of walls, both in and out of doors, under hollow banks, and in depressions in the trunks of large trees. On the under side of this web it takes its station in an inverted position, and watches for its prey. In many parts of Denbighshire and Caernarvonshire it is a common species, and I have been favoured with specimens from the north of Lancashire by Miss Ellen Clayton of Church Town.

42. *Linyphia vivax.* Cephalo-thorace flavescenti-brunneo, fasciis tribus nigris quarum intermediâ anticè bifidâ; mandibulis maxillisque rufescenti-, labio sternoque saturatè brunneis; pedibus palpisque rufescenti-brunneis saturatiùs fasciatis; abdomine flavescenti-brunneo albo-punctato, serie medianâ linearum transversarum angularium nigricantium ad extremitates dilatatarum, fasciis duabus longitudinalibus nigricantibus ad utrumque latus, alterâque latâ medianâ infrà.

Length of the female $\frac{5}{24}$ths of an inch; length of cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{11}$; length of an anterior leg $\frac{1}{2}$; length of a leg of the third pair $\frac{1}{3}$.

Cephalo-thorax oval, convex above, glossy, with a large indentation in the medial line of the posterior region; it is of a yellowish brown colour, with an irregular, longitudinal, blackish band on each side, and a finer one of the same hue, which is bifid in front, extending along the middle.

Eyes placed on black spots on the anterior part of the cephalo-thorax; the intermediate ones form a trapezoid whose anterior side is the shortest; the other four are disposed in pairs on the sides of the trapezoid, those constituting each pair being seated on a small eminence, and contiguous; the posterior eyes of the trapezoid are the largest, and the anterior ones the smallest of the eight. Mandibles reddish brown, powerful, conical, armed with teeth on the inner surface, and slightly inclined towards the sternum, which is heart-shaped, rough with long, erect, black hairs, and is of a dark brown colour. Maxillæ short, strong, straight, and somewhat quadrate, resembling the mandibles in colour. Lip semicircular and prominent at the extremity, which is reddish brown, the base being blackish. Legs and palpi long, slender, and of a reddish brown colour, with blackish brown bands. First pair of legs the longest, then the second, third pair the shortest. The palpi are terminated by a slightly curved claw. Abdomen pointed at the extremity, very convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, and of a yellowish brown colour, freckled with numerous, minute, whitish spots; along the middle extends a series of angular lines of a brownish black hue, whose vertices are directed forwards, and whose extremities, greatly enlarged, form a row of very conspicuous, irregular spots on each side of the medial line; several of the anterior angles are bisected by a fine, brownish black line; two longitudinal, irregular, brownish black bands occur on each side of the abdomen, the upper one being connected with the enlarged extremities of the angular lines by small, confluent spots of the same hue; a large, brownish black band, whose anterior extremity is the broadest, occupies the middle of the abdomen underneath, and comprises a yellowish brown medial line. Sexual organs prominent and brownish black, except at the extremity, which is flesh-coloured. Plates of the spiracles pale yellow.

The male is smaller than the female, but resembles her in colour, design, and the relative length of his legs; the absolute length of these organs, however, is rather greater, an anterior one measuring $\frac{13}{24}$ths of an inch. Third and fourth joints of the palpi short, the former, which is the larger, having several long, curved bristles projecting from its extremity,

in front; the fourth joint is gibbous underneath, and has three short apophyses before, the middle one, which is the largest and darkest coloured, being transversely striated in front; fifth joint somewhat oval, with a slightly curved, conical prominence at the upper part; it is convex and hairy externally, concave within, comprising the palpal organs, which are prominent, highly developed, complicated in structure, with a slightly curved, pointed spine, and a finer one, enveloped in a semitransparent membrane, at their extremity; they are of a red-brown colour. The convex sides of the terminal joints are directed towards each other.

Both sexes of this species, which bears a striking resemblance to *Linyphia cauta*, were discovered in the greenhouse and melon-pits belonging to Mrs. Darbishire, of Green Heys, near Manchester, in September 1836. Compare *Linyphia globosa*, Wider, Mus. Senkenb. i. p. 259. t. 17. f. 9.

43. *Linyphia sylvatica.* Cephalo-thorace mandibulis maxillis labio sternoque saturatè, pedibus palpisque flavescenti-brunneis; abdomine fasciâ medianâ latâ dentatâ saturatè brunneâ albido-marginatâ; lateribus saturatè brunneis fasciâ longitudinali albidâ.

Maris pedes flavescenti-rufi; abdomen subcylindricum, saturatè brunneum, anticè utrinque maculâ albâ notatum.

Length of the female $\frac{1}{5}$th of an inch; length of cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{11}$; length of an anterior leg $\frac{3}{8}$; length of a leg of the third pair $\frac{1}{4}$.

Cephalo-thorax oval, convex above, glossy, with a few slight furrows on the sides, and a large indentation in the medial line of the posterior region. Mandibles powerful, conical, convex in front, armed with two rows of teeth on the inner surface, and slightly inclined towards the sternum, which is heart-shaped. Maxillæ strong, straight, and somewhat quadrate. Lip semicircular and prominent at the extremity. These parts are of a very dark brown colour, the cephalo-thorax being the palest. The intermediate eyes form a trapezoid, whose anterior side is the shortest, the posterior pair being the largest of the eight. Legs and palpi long, slender, and of a yellowish brown colour, occasionally tinged with

green. First pair of legs the longest, then the second, third pair the shortest. The palpi have a slightly curved claw at the extremity. Abdomen thinly covered with hairs, glossy, very convex above, projecting over the base of the cephalo-thorax; a broad, dentated, dark brown band, bordered with yellowish white, occupies the medial line of the upper part; sides dark brown, with a large, irregular, yellowish white band extending along each, and uniting above the spinners; underside, and plates of the spiracles dark brown, the latter having a tinge of red. The sexual organs have two large, external orifices, and a small, oval process connected with their inferior margin.

The male bears little resemblance to the female. He is rather smaller, and the mandibles, which are very powerful, have a small, obtuse prominence at the base, numerous minute tubercles in front and on the outer side, and are armed with a large tooth, and several small ones on the inner surface. Maxillæ inclined towards the lip. Legs yellowish red, the haunches and thighs being the reddest. Fourth joint of the palpi stronger than the third; it is somewhat produced at its extremity, in front, and has some fine, long bristles on the outer side; fifth joint of an elongated oval form, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a pointed, corneous process, directed obliquely downwards and outwards, and a spiral spine, enveloped in membrane, at their extremity; they are of a dark reddish brown colour. Abdomen nearly cylindrical, projecting a little over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and dark brown, with an irregular white spot on each side of the anterior part, on the upper side, near the cephalo-thorax.

Linyphia sylvatica pairs in May and June. It is common in Denbighshire and Caernarvonshire, constructing its web among grass and plants growing in and near woods. In the summer of 1838, I received specimens of this species from Miss Ellen Clayton, who captured them in the north of Lancashire. The male closely resembles the male of *Linyphia fuliginea*, but may be distinguished from it by its superior size, and by the structure of its palpal organs. Compare *Linyphia pratensis*, Wider, Mus. Senkenb. p. 258. t. 17. f. 8.

44. *Linyphia rubea.* Cephalo-thorace anticè saturatè, posticè flavescenti-brunneo; mandibulis maxillis labio sternoque saturatè, palpis pedibusque flavescenti-brunneis, his virescentibus; abdomine fasciâ medianâ latâ dentatâ brunneâ, laterali utrinque albâ, strigâque brevi brunneâ ab ano utrinque sursùm ductâ; lateribus brunneis lineis duabus flavescentibus, anticâ horizontali posticâ fere verticali.

Length of the female $\frac{3}{20}$ths of an inch; length of cephalo-thorax $\frac{1}{18}$; breadth $\frac{1}{21}$; breadth of abdomen $\frac{1}{12}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{7}$.

Cephalo-thorax oval, convex above, glossy, with a large indentation in the medial line of the posterior region; its colour is yellowish brown, with the exception of the anterior part, which is dark brown. Mandibles powerful, conical, armed with teeth on the inner surface, and slightly inclined towards the sternum, which is broad and heart-shaped. Maxillæ robust, straight, and somewhat quadrate. Lip semicircular and prominent at the extremity. These parts are dark brown, the mandibles and lip being the darkest. Eyes placed on black spots, the anterior pair of the trapezoid being the smallest of the eight. Legs slender, and of a yellowish brown colour, tinged with green; first pair the longest, then the second, third pair the shortest. Palpi yellowish brown, with a slightly curved claw at the extremity. Abdomen thinly clad with hairs, glossy, very convex above, projecting over the base of the cephalo-thorax; a broad, dentated, brown band, which is darkest at its posterior extremity, extends along the middle of the upper part, nearly to the spinners; on each side of the brown band is an irregular white one; these white bands unite immediately above the spinners, and a short, brown streak is directed upwards from each side of the anus; the sides are brown, obscurely mottled with yellowish spots, and are marked with two yellowish lines on the lower part, the anterior one being horizontal, and the posterior one nearly vertical; the under part is brown, a large space in the middle having a tinge of yellow. The sexual organs, which are very dark brown, approaching to black, have a minute prominence on their inferior margin. Plates of the spiracles brown.

The male is smaller and slenderer than the female, but the relative length of his legs is the same; their absolute length, however, is greater, an anterior one measuring $\frac{3}{10}$ths of an inch. He resembles the female in design, but is darker coloured. The cephalo-thorax, mandibles, maxillæ, lip, and sternum, have a tinge of red, and the legs are without the green tint perceptible on those of the other sex. Fourth joint of the palpi much stronger than the third, a long, slender bristle projecting from each, near the extremity, in front; fifth joint oval, very dark brown, convex and hairy externally, concave within, comprising the palpal organs, which are prominent, highly developed, complicated in structure, with a pointed, corneous spine, directed from the inner side obliquely downwards, and a delicate, prominent membrane at the extremity; their colour is very dark reddish brown.

In May and June *Linyphia rubea* spins a web of moderate extent in bushes, and is of frequent occurrence in the woods of Denbighshire and Caernarvonshire. It has been captured by Miss Ellen Clayton in the north of Lancashire, and by T. Glover, Esq. in the neighbourhood of Manchester.

45. *Linyphia insignis.* Cephalo-thorace mandibulis maxillisque flavescenti-, labio sternoque saturatè, pedibus palpisque pallidè flavescenti-brunneis; abdomine obscurè flavo, lineis transversis medianis angularibus fasciâque utrinque longitudinali nigricantibus.

Length of the female $\frac{3}{20}$ths of an inch; length of cephalo-thorax $\frac{1}{16}$; breadth $\frac{1}{20}$; breadth of abdomen $\frac{1}{16}$; length of an anterior leg $\frac{5}{16}$; length of a leg of the third pair $\frac{1}{4}$.

Cephalo-thorax oval, convex above, glossy, with some slight furrows on the sides, and a large indentation in the medial line of the posterior region; its colour is yellowish brown, the margins being the darkest. Mandibles powerful, conical, vertical, and armed with a few teeth on the inner surface. Maxillæ straight, and somewhat quadrate. These organs resemble the cephalo-thorax in colour, but are rather darker. Lip semicircular and prominent at the extremity. Sternum heart-shaped. These parts are dark brown, the lip being paler at the tip. Legs and palpi long,

slender, and pale yellowish brown. First pair of legs the longest, then the second, third pair the shortest. Eyes seated on black spots. Abdomen oviform, glossy, thinly covered with hairs, convex above, projecting over the base of the cephalo-thorax; it is of a dull yellow colour, with a series of blackish, angular lines, whose vertices are directed forwards, extending along the middle of the upper part, a longitudinal band of the same hue on each side, and an irregular, blackish spot above the plate of each spiracle. A very long, subcylindrical process of a red-brown colour, notched at the extremity, is directed backwards from the sexual organs, with which it is connected. Plates of the spiracles pale yellow.

The spider from which the foregoing description was taken was captured by Mr. J. Parry at Trafford, near Manchester, in the autumn of 1837.

46. *Linyphia furva.* Saturatè brunnea ferè nigra; pedibus palpisque flavescenti-brunneis.

Length of the female $\frac{1}{9}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{28}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{5}{24}$; length of a leg of the third pair $\frac{1}{7}$.

Cephalo-thorax oval, convex above, glossy, with an indentation in the medial line of the posterior region. Mandibles long, conical, divergent at the extremity, armed with teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ strong, straight, and somewhat quadrate. Lip semicircular and prominent at the tip. These parts are very dark brown, approaching to black, the mandibles and maxillæ being the palest. Legs and palpi long, slender, and yellowish brown, the latter being the darker. First pair of legs the longest, then the second, third pair the shortest. The posterior eyes of the trapezoid are the largest, and the anterior ones decidedly the smallest of the eight. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and brownish black. A small, prominent, cylindrical process is connected with the inferior part of the sexual organs. Plates of the spiracles brown.

The male is rather smaller than the female, but resembles her in colour, and in the relative length of his legs; these organs, however, have

a greater absolute length, an anterior one measuring $\frac{11}{48}$ths of an inch. Third and fourth joints of the palpi short, the latter, which is much the stronger, being produced on the inner side; fifth joint somewhat oval, with a prominent lobe near the extremity, on the inner side; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with two contiguous, black, spiral spines, enveloped in a delicate membrane, at their extremity; they are of a dark reddish brown colour.

This species was found under stones in a moist pasture at Oakland, in May 1838.

47. *Linyphia Claytoniæ.* Maris cephalo-thorace appendicibusque pallidè flavescenti-rufis; labio sternique marginibus brunneis; abdomine livido.

Length of the male $\frac{1}{10}$th of an inch; length of cephalo-thorax $\frac{1}{18}$; breadth $\frac{1}{24}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{8}$.

Cephalo-thorax oval, convex above, glossy, with an indentation in the medial line of the posterior region, and some fine bristles, directed forwards, on the middle of the anterior part. Mandibles long, powerful, conical, provided with a small protuberance in front, near the base, one or two minute teeth on the inner surface, and inclined towards the sternum, which is broad and heart-shaped. Maxillæ straight, and somewhat quadrate. Lip semicircular and prominent at the extremity. Legs long and slender, first pair the longest, then the second, third pair the shortest. These parts are of a light yellowish red colour, with the exception of the lip, and the margins of the sternum, which are brown. Eyes seated on black spots, those constituting the anterior pair of the trapezoid being the smallest of the eight. The palpi resemble the legs in colour; third and fourth joints short, the latter being much the stronger; fifth joint oval, convex and hairy externally, concave within, comprising the palpal organs, which are prominent, highly developed, complicated in structure, with two contiguous, curved spines, enveloped in membrane, near their middle, and of a red-brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly clad with

hairs, glossy, and appears to be livid; but, as the specimen had been some time in spirits when I made the description from it, I cannot speak with certainty concerning its colour.

I have named the above species in compliment to Miss Ellen Clayton, of Church Town, near Garstang, Lancashire, who discovered it in the neighbourhood in which she resides. To the zeal of this lady in collecting specimens, and to her kindness in forwarding them to me for description, I am indebted for this and other interesting spiders.

48. *Linyphia obscura.* Maris cephalo-thorace mandibulis maxillis labio sternoque saturatè, pedibus palpisque flavescenti-brunneis paululùm rufo tinctis, horum articulo terminali saturatè brunneo; abdomine nigricante.

Length of the male $\frac{1}{12}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{28}$; breadth of abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{10}$.

Anterior part of the cephalo-thorax compressed; sides marked with slight furrows diverging from the upper part towards the margins; in the medial line of the posterior region there is an indentation. The posterior eyes of the trapezoid are much the largest, and the anterior ones the smallest of the eight. Mandibles conical, armed with a few teeth on the inner surface, and inclined towards the sternum, which is heart-shaped. Maxillæ strong, pointed at the extremity, on the inner side, encompassing the lip, which is semicircular and prominent at the tip. These parts are of a dark brown colour; the cephalo-thorax, which is the darkest, is almost black, and the maxillæ are the palest. Legs long, and yellow-brown, with a slight tinge of red; first pair the longest, then the second, third pair the shortest. The palpi resemble the legs in colour, with the exception of the terminal joint, which is dark brown; third and fourth joints short, a long, slender bristle being connected with the former, at the anterior part of its extremity; fifth joint somewhat oval, with a projection on the outer side, and a conical, acute, slightly curved process, directed upwards, at its superior part; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly deve-

loped, and very complicated in structure, having on the outer side of the upper part a curved, corneous process, bifurcated at the extremity, an obtuse, glossy prominence lower down, and a long, acute spine directed downwards and outwards; they are of a dark red-brown colour. Abdomen oviform, convex above, projecting over the base of the cephalo-thorax; it is thinly clad with hairs, glossy, and brownish black. Plates of the spiracles dark brown.

Adult males of this species were taken in June 1836, on rails at Oakland.

49. *Linyphia gracilis.* Mas nigricans; mandibulis maxillis pedibus palpisque brunneis paululùm rufo tinctis.

Length of the male $\frac{1}{12}$th of an inch; length of cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{32}$; breadth of abdomen $\frac{1}{30}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{10}$.

Anterior part of the cephalo-thorax compressed; sides marked with furrows diverging from the upper part to the margins; in the medial line of the posterior region there is a large indentation. Mandibles conical, armed with a few teeth on the inner surface, and inclined towards the sternum, which is heart-shaped, convex, glossy, and provided with some scattered hairs. Maxillæ strong, enlarged at the base, where the palpi are inserted, and slightly inclined towards the lip, which is semicircular and prominent at the extremity. The cephalo-thorax, sternum, and lip are brownish black, and the mandibles and maxillæ brown, faintly tinged with red. The posterior eyes of the trapezoid are the largest, and the anterior ones much the smallest of the eight. Legs long, slender, and pale brown, tinged with red. The palpi are short, and resemble the legs in colour, with the exception of the terminal joint, which is darker; fourth joint much stronger than the third; fifth oval, convex and hairy externally, concave within, comprising the palpal organs, which are prominent, highly developed, complicated in structure, with a small, glossy protuberance on the outer side of the upper part, and a fine spine at the extremity, enveloped in a delicate membrane, and curved into a circular form; they are of a red-brown colour. The convex sides of the terminal joints are directed towards each other. Abdomen oviform, convex above,

projecting over the base of the cephalo-thorax; it is thinly covered with hairs, glossy, and brownish black. Plates of the spiracles dull brown. Some individuals have an obscure series of angular lines of a brownish hue, whose vertices are directed forwards, extending along the middle of the upper part of the abdomen.

Males of this spider, in a mature state, were found on rails in the township of Crumpsall, in November 1836.

Genus MANDUCULUS*, *Blackw.*

50. *Manduculus limatus.* Cephalo-thorace sternoque rufo-brunneis, illo fasciâ medianâ maculisque paucis lateralibus nigris; mandibulis maxillis labioque saturatè rufescenti-, pedibus palpisque flavescenti-brunneis; pedum pari 1mo longissimo, dein 2do, 3tio brevissimo; abdomine rufo-brunneo serie medianâ linearum angularium albarum, fasciâque utrinque laterali latâ flavescente supernè pallidiore infernè rufo-brunneo tinctâ.

Length of the female $\frac{1}{6}$th of an inch; length of cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of abdomen $\frac{1}{12}$; length of an anterior leg $\frac{7}{24}$; length of a leg of the third pair $\frac{1}{6}$.

Cephalo-thorax rather large, oval, convex above, glossy, and rough, like shagreen; the anterior part, where the eyes are situated, is slightly elevated, and rounded, and there is an indentation in the medial line of the posterior region; its colour is red-brown, with a black band extending along the middle, and a few obscure spots of the same hue on the sides, just above the margins. The sternum is heart-shaped, and rough, resembling in colour the ground of the cephalo-thorax. Mandibles remarkably powerful, conical, convex in front, widely divergent at the extremity, armed with two rows of teeth on the inner surface, and of a very dark reddish brown colour, approaching to black. Maxillæ inclined towards the lip, which is triangular; these organs are dark reddish brown, the latter being rather the darker. Legs and palpi long, slender, and yellowish brown. First pair of legs the longest, then the second, third pair the

* For the characters of this genus, see the London and Edinburgh Philosophical Magazine and Journal of Science, vol. iii. p. 110–11; and Researches in Zoology, p. 358–9.

shortest. Each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. The palpi have a curved, pectinated claw at the extremity. Abdomen oviform, thinly covered with short hairs, convex above, projecting over the base of the cephalo-thorax; it is of a red-brown colour, with a series of white, angular lines, whose vertices are directed forwards, extending along the middle of the upper part; on each side is a broad, irregular, yellowish band, which is palest on the upper edge, and is tinged with light red-brown below; underneath, an obscure, yellowish streak extends along each side of the medial line. Plates of the spiracles dull yellow.

The male resembles the female in colour, and in the relative length of his legs, but is rather smaller than she is. The nails of the mandibles have a slight indentation near the middle, externally, and a corresponding projection on the inner side. Fourth joint of the palpi longer than the third, and clavate; the fifth joint consists of two parts; the shorter and slenderer one is attached to the upper side of the palpal organs, and the longer one is connected with the same organs on the inner side, and extends a little beyond them. Palpal organs glossy, of a globular form, with a pointed elongation anteriorly, which has the appearance of being twisted; their colour is very dark reddish brown, approaching to black.

Manduculus limatus occurs under stones and on bushes in the woods about Oakland. The male has the palpal organs completely developed in September. Compare *Linyphia tenebricola*, Wider, Mus. Senkenb. i. p. 267. t. 18. f. 2.

Family Epeïridæ.

Genus Epeïra, *Walck.*

51. *Epeïra celata.* Cephalo-thorace pallidè brunneo, marginibus strigis paucis transversis lateralibus fasciâque medianâ anticè pallidè brunneo-maculatâ nigris; mandibulis maxillisque saturatè rufescenti-brunneis; labio sternoque nigricantibus; pedibus palpisque flavescenti-brunneis albo-maculatis fasciatisque; pedum pari 1mo longissimo, dein 2do, 3tio brevissimo; abdomine nigro brunneoque vario fasciâ medianâ latâ dentatâ anticè angustatâ lineâque brevi decussante flavis.

Length of the female $\frac{7}{20}$ths of an inch; length of cephalo-thorax $\frac{3}{20}$; breadth $\frac{1}{9}$; breadth of abdomen $\frac{1}{8}$; length of an anterior leg $\frac{2}{3}$; length of a leg of the third pair $\frac{5}{16}$.

Anterior part of the cephalo-thorax compressed; sides marked with slight furrows diverging from the upper part to the margins; there is a large indentation in the medial line of the posterior region; colour pale brown, with black margins, a few transverse, black streaks on the sides, and a band of the same hue extending along the middle, and increasing in breadth as it approaches the eyes, where it comprises several pale brown spots. Eyes disposed in two transverse rows on the anterior part of the cephalo-thorax; the four intermediate ones form a square, and those of each lateral pair, which are nearly contiguous, together with the eyes of the anterior intermediate pair, are seated on small eminences. Mandibles powerful, conical, convex in front, armed with two rows of teeth on the inner surface, and inclined towards the sternum; their colour is very dark brown, tinged with red. Maxillæ straight, enlarged and rounded at the extremity, and dark reddish brown. Lip semicircular and brownish black, having a faint tinge of red at the tip, which is prominent. Sternum heart-shaped, with prominences on the margins, opposite to the insertion of the legs; its colour is brownish black. Legs and palpi long; their colour is yellowish brown, with black spots and rings; the tarsi are reddish. First pair of legs the longest, then the second, third pair the shortest. Abdomen oviform, thickly covered with hairs, convex above, projecting over the base of the cephalo-thorax; it is mottled with black and brown, having an obscure, yellowish, curved line on each side of the anterior part, and a broad, dentated, yellow band extending along the middle of the upper part; this band, which comprises a fine, longitudinal, branched line of a darker hue, is narrowest at its anterior extremity, near which a short, yellow line crosses it at right angles; on each side of the middle of the under part is a longitudinal, yellow line. Plates of the spiracles pale brown.

The male is smaller than the female, but resembles her in colour, and in the relative length of his legs. Third and fourth joints of the palpi short; the latter is the stronger, and has a pointed apophysis at the extre-

mity, in front; the fifth joint consists of three parts, one of which projects boldly in front; this process is curved, glabrous, transversely striated above, and has a thin membrane attached to it; another part, united to the base of the curved process on the outer side, is slender and hairy; and the third part, which is much the largest, is oval, convex and hairy externally, and concave within; all three are connected with the palpal organs, which are moderately developed, rather complicated in structure, and of a reddish brown colour. The convex sides of the oval parts of the fifth joints are directed towards each other.

This species, like *Epeïra antriada*, to which it is nearly allied, frequents damp caverns, and hollow banks, to the sides of which it attaches its subglobular cocoon in the month of May. This cocoon, which is composed of whitish silk of a loose texture, is depressed on the attached side, and measures about half an inch in diameter; it comprises between two and three hundred spherical eggs of a yellow colour, agglutinated together in a lenticular mass measuring $\frac{3}{10}$ths of an inch in diameter.

XLIII. *Account of two new Genera allied to* Olacineæ. *By* George Bentham, *Esq., F.L.S.*

Read December 15th, 1840.

Among the plants collected by Mr. Schomburgk in British Guiana, are two species of a new genus allied in many respects to the order of *Olacineæ*; and in a collection from a very different quarter, Port Natal in South Africa, communicated to me by Mr. Harvey, are fine specimens in flower and fruit of another new genus related to the same order, *Apodytes dimidiata*, named by Ernst Meyer among Drège's plants, but as yet undescribed. As the determination of these genera has led me into some inquiry as to the affinities of others belonging to the same group, and as they may serve in some measure to throw light upon this small but curious order, I beg to offer to the Linnean Society the accompanying figures and descriptions, together with such observations as have suggested themselves to me.

The *Olacineæ* were first established as a distinct order by Mirbel*, who placed them among *Polypetalæ* near *Aurantiaceæ*. Jussieu†, in adopting the order, insisted upon its near relation to *Symploceæ*, near which he had originally‡ enumerated *Olax* amongst the "genera Sapotis affinia." Brown afterwards § replied to Jussieu's objections to the affinities he had formerly ‖ pointed out between *Olax* and the *Santalaceæ*, and admitting the *Olacineæ* as a separate order, still concluded, nevertheless, that they should be placed next to *Santalaceæ*. Since that time, however, botanists do not appear generally to have adopted that opinion; and DeCandolle¶, Wight and Arnott**,

* *Nouv. Bull. de la Soc. Philomathique*, 1813, p. 377.

† *Mémoires du Muséum*, vol. ii. p. 439.

‡ *Genera Plantarum*, p. 153.

§ Appendix to Flinders' Voyage, p. 570, and Appendix to Tuckey's Congo, p. 552. (*Verm. Schr. ed. Nur.*, vol. i. pp. 89 and 260.)

‖ *Prodr. Fl. Nov. Holl.*, p. 357.

¶ *Prodr. Syst. Nat.*, vol. i. p. 531.

** *Prodr. Fl. Penins. Ind. Orient.*, vol. i. p. 88.

Meisner*, and lastly Endlicher†, have all, with much doubt it is true, placed them near *Aurantiaceæ,* whilst Lindley‡ inserts them, with equal hesitation, among his *Pittosporales*§.

The genera usually considered as true *Olacineæ,* are *Olax,* Linn., (including *Spermaxyrum,* Labill., and *Fissilia,* Commers.,) *Heisteria,* Linn., *Ximenia,* Linn., *Gomphandra,* Wall., and, as anomalous forms, *Opilia,* Roxb., (including *Groutia,* Guillem.,) and *Icacina,* Adr. Juss. To these I propose to add, besides *Apodytes,* E. Meyer, Schomburgk's new genus, which I have called *Pogopetalum,* and *Leretia,* Vellozo, now first described, also *Schœpfia,* Schreb., and *Cansjera,* Lam. I do not advert to the genera of Du Petit Thouars and Blume, usually enumerated at the end of *Olacineæ,* nor to *Quilesia* of Manuel Blanco, because, until they shall have been more completely or more accurately described, their affinities can only be guessed at; and *Balanites* has long since been rejected by Jussieu, though still occasionally added to *Olacineæ,* for no other reason that I can perceive but from its having once been considered as a species of *Ximenia.*

The above-named genera consist chiefly of trees or shrubs, occasionally climbing, unarmed, or in *Ximenia* and some species of *Olax,* bearing axillary spines. The leaves are alternate, exstipulate, simple and entire, neither glandular nor dotted. The inflorescence is terminal only in *Icacina* and *Apodytes,* where it is corymbose; in all the other genera it is axillary; glomerate in *Heisteria*; racemose in *Ximenia, Olax, Schœpfia, Opilia* and *Cansjera,* the flowers being often distichously arranged in the racemes, sometimes irregular and even solitary in the Australian, one East Indian, and one American species of *Olax*; cymose in *Pogopetalum, Leretia,* and in the male individuals of *Gomphandra.* The bractes at the base of the pedicels are membranous and very small, excepting in *Opilia,* where they are broad and imbricate before the raceme is fully developed. Bracteolæ are present in *Schœpfia.*

The flowers are hermaphrodite in most cases, unisexual by abortion in *Gomphandra,* and occasionally polygamous in *Leretia.*

* *Plantarum Vascularium Genera,* p. 45, Commentarius, p. 33.

† *Genera Plantarum,* p. 1041.

‡ Introduction to the Natural System, p. 32.

§ Since this paper was read, I have received Decaisne's Memoir on the Mistletoe, in which he fully concurs in Brown's views of the close affinity between the *Olacineæ* and *Santalaceæ*

The calyx at the time of flowering is very small, cupuliform, with the margin entire, or bearing as many minute teeth as there are petals. It is quite free in *Ximenia*, *Heisteria*, *Gomphandra*, *Icacina*, *Apodytes*, *Leretia* and *Pogopetalum*, very slightly adherent to the ovary in the East Indian and Australian species of *Olax*, and decidedly adherent, with a very short, free and entire margin in the American species of *Olax* and in *Schœpfia*. In *Opilia* and *Cansjera* it is little more than a dilatation of the torus with four or five scarcely perceptible teeth, so that these genera appear at first sight monochlamydeous. As the fruit ripens the calyx of *Olax* enlarges and incloses the drupe nearly to the top, but without adhering to it. In *Schœpfia* it enlarges in the same manner, but adheres closely to the fruit, as in *Symplocos*. In *Heisteria* it becomes also much enlarged, but is spread out under the fruit without inclosing it. In *Ximenia*, *Opilia*, *Gomphandra*, *Apodytes*, *Icacina*, *Leretia* and *Pogopetalum* it persists, but does not increase in size.

The corolla, hypogynous where the calyx is entirely free, more or less perigynous according to the degree of adherence of the calyx, consists of four, five or six petals, always valvate in their æstivation, usually of a thickish consistence, and more or less cucullate at the apex, where they usually terminate in an inflexed point. They cohere together in the form of a monopetalous corolla above the middle in *Schœpfia* and *Cansjera*; they are joined in pairs in *Olax*, and often cohere slightly at the base in the other genera, but usually are entirely detached from each other when the flower is fully open.

The stamens, inserted with the petals, are free, or more or less connected with the latter; their number is definite, and never exceeds double that of the petals. When this number is complete they are placed in two series, the inner one opposite the petals, the outer one alternating with them. In *Ximenia* and *Heisteria* both series are complete and fertile. In *Gomphandra*, *Icacina*, *Apodytes*, *Leretia* and *Pogopetalum* the outer series are alone complete and fertile, the inner one being wanting. In *Olax* the outer series are complete, but reduced to three (or sometimes four?), the inner series reduced to simple or bifid filaments. In *Opilia* and *Cansjera* the outer series are reduced to scale-like processes, whilst the inner are complete and fertile. In *Schœpfia* the inner series are also complete and fertile, but the outer ones are totally

wanting. The anthers are always introrse, fixed by the back, bilocular, the cells nearly parallel and opening longitudinally; they are usually versatile, but adnate in *Gomphandra.*

Thick matted hairs are present in the flowers of many species; along the middle nerve of the petals on the inside in *Ximenia, Leretia* and *Pogopetalum*; immediately above the part where the stamens cohere to the petals in most species of *Olax* and in *Schœpfia fragrans*; at the top of the filaments in some *Gomphandræ.*

The pistillum is simple and sessile on the torus, which is sometimes thick and of a glandular texture, but never encircling the ovary or projecting in the form of distinct glands. The style is simple, terminating either in a thin, truncate, apparently entire stigmatic surface, or in a two-, three- or four-lobed, thick, fleshy stigma.

The ovary is thick and fleshy, containing one, or (in *Pogopetalum*) three small cavities, in which are one, two, three or four ovules suspended from the apex of a placenta which arises from the base of the cavity, and is entirely free, or more or less connate with spurious incomplete dissepiments, or with the side of the ovary next to the style, which is in the latter cases excentrical. In *Ximenia, Heisteria, Olax* and *Schœpfia* the placenta is nearly central, bears three or four ovules, and is more or less connected with as many spurious dissepiments, which are exceedingly short in the Australian and some East Indian species of *Olax*, but reach nearly to the insertion of the ovules in other species of *Olax*, in *Ximenia*, and in *Schœpfia.* In *Opilia* and *Cansjera* the placenta is almost entirely free, and has the appearance of an erect ovule, but under a strong glass it is seen to bear a single minute ovule suspended from the apex; in the young bud, it has appeared to me that there are two ovules in *Opilia*, three or four in *Cansjera*, a circumstance rendered probable by the evidently compound nature of the stigma in both genera, but which, on account of the excessive minuteness of the parts, I am unable to ascertain with certainty from dried specimens. After fecundation I never find traces of more than one ovule.

In *Icacina*, (*Gomphandra*?,) *Apodytes* and *Leretia* there are always two ovules collaterally suspended, or nearly so, but (in *Apodytes*, at least), owing to the lengthened thread by which one of them hangs, they are placed above one

another in the cell; the placenta adheres to the side of the cavity next to the excentrical style. In *Pogopetalum* the ovules are placed as in *Apodytes*, but there are three cells, not radiating from the centre of the ovary, but diverging from the side next to the excentrical style.

In *Ximenia*, *Schœpfia*, and several species of *Olax* the ovules taper into a long point, which before fecundation is curled upwards in *Ximenia*. In *Heisteria* they are long and slightly thickened at the extremity. In other species of *Olax* they are ovate. In *Opilia* and *Cansjera* they are very minute, and look like a hooked point to the placenta. In *Apodytes*, *Leretia* and *Pogopetalum* they are short and broad, and remarkably cellular in their texture.

The fruit (which I have only seen ripe in *Heisteria*, *Olax*, *Schœpfia*, *Cansjera* and *Apodytes*, and unripe in *Pogopetalum*, but which has been described from ripe specimens also in *Ximenia*, *Heisteria*, *Opilia* and *Gomphandra*, and from unripe ones in *Icacina*) is a drupe with a thin, fleshy, or sometimes nearly dry pericarp and a crustaceous or osseous putamen, which is almost always one-celled and one-seeded by abortion. It is generally of an oblong, ovoid, or nearly globular form, but of a very remarkable, almost kidney shape, in *Apodytes*, with a fleshy protuberance from the hollow side.

The seed, of the same form as the drupe, fills the cell; the testa is of exceeding tenuity, and indeed, in many specimens I have opened, it can scarcely be distinguished from the albumen, which fills the seed and is of a fleshy or somewhat cartilaginous consistence. In its axis is a narrow cavity, at the upper end of which (that is, in relation to the fruit) is a straight embryo, usually very short, with a short radicle pointing upwards (with relation to the fruit), and ovate or oblong cotyledons. The plumula is inconspicuous. In *Olax*, *Heisteria*, *Schœpfia* and *Cansjera*, and probably also in *Ximenia* and *Opilia*, the placenta becomes combined with the seed, and assumes the form of a thin cord or mere furrow up one side. The seed then becomes to all appearance erect, attached by a broad umbilicus at the base, the embryo being at the opposite end, although, physiologically speaking, the broad umbilicus is the base of the placenta, and the real hilum is the extremity of the cord or furrow at the opposite end. This structure is plainly indicated in Gærtner's figure of *Olax scandens* (Carpol. Suppl. p. 119. t. 201.), but appears to have been

misunderstood by others, who have imagined that the broad umbilicus is directed towards the apex of the fruit*.

In *Apodytes,* and (as far as I can ascertain from unripe fruit or descriptions) in *Pogopetalum, Icacina* and *Gomphandra,* where the placenta is combined with the side of the fruit, the seed is pendulous from near the top of the cell, and the radicle is consequently next the hilum.

The most important of the above variations of character may be condensed in the following synoptical view of the order.

OLACINEÆ.

Calyx parvus, liber v. basi adnatus, truncatus v. denticulatus, fructifer persistens immutatus v. auctus. *Corollæ petala* 4, 5, v. 6 hypogyna v. subperigyna subcoriacea, æstivatione valvata, libera v. per paria connexa v. basi in tubum coalita. *Stamina* definita, cum petalis inserta, iis coalita v. libera, numero petalorum dupla v. æqualia, fertilia rarius asymmetrica, alterna sæpe sterilia difformia. *Antheræ* introrsæ biloculares, loculis rima longitudinali dehiscentibus. *Ovarium* toro nunc parvo, nunc incrassato et interdum cum calyce concreto insidens, uniloculare (nunc spurie et incomplete 3—4-loculare), v. rarius excentrice triloculare. *Ovula* in loculo 2, 3, v. 4 collateralia, rarius solitaria, ab apice placentæ liberæ v. ovario v. dissepimentis spuriis connatæ pendula, anatropa. *Stylus* erectus simplex; stigmate nunc truncato tenui, nunc incrassato 2-, 3-, 4-lobo. *Drupa* calyce immutato stipata v. ampliato cincta, velata, v. adnata; pericarpio tenui carnoso v. exsucco, putamine crustaceo v. os-

* De Candolle (*Prodr.* i. p. 531) says, "Semen pendulum, basi umbilicatum;" Lindley (*Introd.* p. 32) has, "Seed pendulous;" and Wight and Arnott (*Prodr.* p. 88), "Seed usually pendulous," without mention, however, of the broad apparent umbilicus, which, rather than the real inconspicuous umbilicus, appears to me to be alluded to by DeCandolle. Endlicher (*Gen. Pl.* p. 1041) enters into more detail: "Semen inversum .... umbilico basilari apicem fructus respiciente, ope rhapheos filiformis, interdum obsoletæ, cum chalaza apicali, basim carpicam spectante, conjuncto;" a description which only agrees with what I have above described, on the supposition that he speaks of the physiological but inconspicuous umbilicus and rhaphe, and not of the remains of the placenta, which assume so much the appearance of an umbilicus and rhaphe. In Wight's Illustrations (t. 40) the fig. 9. referred to in the explanation as a bad representation of the seed "cut lengthwise to show the whole length of the embryo," gives a tolerably fair idea of the *outside* of the seed with the trace of the placenta.

seo, abortu monospermo, rarius 2—3-spermo. *Semen* inversum, sæpius placenta cum illo a basi concreta spurie erectum, umbilico spurio lato imo loculo affixum, nunc ab apice loculi lateraliter pendulum. *Embryo* in axi albuminis copiosi carnosi, rectus, apici fructus proximus, nunc brevissimus rarius dimidio albuminis longior, radicula apicem fructus spectante brevissima, cotyledonibus semiteretibus, plumula inconspicua. *Arbores* v. frutices erecti v. interdum scandentes, inermes v. ramis axillaribus spinescentibus armati, glabri v. parce pubescentes. *Folia* alterna simplicia, integerrima, exstipulata, eglandulosa. *Flores* hermaphroditi v. abortu polygami, nunc axillares disticbe v. irregulariter racemosi, spicati v. cymosi, nunc terminales cymoso-paniculati, rarius solitarii laterales v. axillares. *Bracteæ* squamæformes sæpius minutæ, rarius juniores imbricatæ. *Bracteolæ* parvæ in cupulam connatæ, v. nullæ.

Tribe I. OLACEÆ.

Ovarium basi dissepimentis spuriis (rarius evanidis) 3—4-loculare, apice 1-loculare, placenta centrali dissepimentis spuriis basi adhærente superne libera. *Ovula* tot quot loculi spurii ex apice placentæ pendula. *Semen* spurie erectum. *Inflorescentia* axillaris, racemosa, racemis rarius ad florem unicum reductis.

1. HEISTERIA*. *Calyx* liber, fructifer maximus patens. *Petala* 5 libera v. basi connata. *Stamina* numero petalorum dupla, omnia fertilia, filamenta libera, hypogyna v. basi petalis adnata. *Flores* parvi, glomerati.

2. XIMENIA†. *Calyx* liber, fructifer immutatus. *Petala* 4—5, libera. *Stamina* numero petalorum dupla, omnia fertilia, libera, hypogyna.

* I have examined a specimen in flower and fruit in Mr. Miers' herbarium, of a species scarcely, if at all, distinct from *H. parvifolia*, Sm., although a native of the Organ Mountains instead of Sierra Leone. Of the other species I have seen only the specimens in the herbaria of Banks and Smith.

† *X. parviflora*, Benth. (Pl. Hartw. p. 7), and *X. americana*, from Timor specimens, from the Paris herbarium; Æthiopian specimens, Kotschy (n. 452); and American ones, Cuming (n. 1120), Gardner (n. 938), Blanchet (n. 2787), and several others, all in flower only. I have not seen the fruit. In describing the *X. parviflora*, I had overlooked the circumstance that the dissepiments of the ovary did not reach the point where the ovules are inserted, a fact first pointed out to me by Decaisne in the autumn of 1839.

3. OLAX*. *Calyx* liber v. toro incrassato necnon ovarii basi plus minusve adhærens, fructifer ampliatus drupam involvens. *Petala* nunc sex per paria connexa, nunc quinque quinto libero. *Stamina* cum petalis basi connata, fertilia 3 petalis alterna, sterilia tot quot petala et iis opposita, filiformia, integra v. bifida.

4. SCHŒPFIA†. *Calyx* toro incrassato necnon ovarii basi adhærens, margine libero brevissimo truncato, fructifer drupam includens et ei adnatus. *Corolla* gamopetala 4-, 5-, 6-fida. *Stamina* tot quot laciniæ corollæ et iis opposita, omnia fertilia, filamentis tubo corollæ alte adnatis. *Bracteolæ* sub calyce parvæ in cupulam inæqualiter 3—4-fidam connatæ.

* I have examined the flowers of *O. stricta*, Br., *O. nana*, Wall., *O. zeylanica*, Linn., *O. scandens*, Roxb., *O. imbricata*, Roxb., *O. Wightiana*, Wall., *O. acuminata*, Wall., *O. macrophylla*, m., and *O. pauciflora*, m., and fruits of *O. nana*, *zeylanica* and *scandens*. Among the above species the following are as yet undescribed :—

O. nana (Wall. Cat. Herb. Ind. n. 6783.), suffruticosa ? glabriuscula ramis erectis parce ramosis, foliis subsessilibus oblongis lanceolatisve obtusis vix mucronulatis, pedicellis axillaribus solitariis unifloris, calyce libero, staminibus sterilibus bifidis.—Napalia ? Wallich.

O. acuminata (Wall. l. c. n. 6781.), fruticosa scandens ? glabra, ramis angulatis, foliis ovato-lanceolatis acuminatis, racemis brevibus distichis paucifloris, calyce toro incrassato basi breviter adnato, staminibus sterilibus bifidis.—Affinis *O. zeylanicæ*, foliorum forma, floribus minoribus paucioribus diversa.—Sillet, Wallich.

O. macrophylla, sp. n., glaberrima, foliis ovato-lanceolatis acuminatis inæquilateris, racemis axillaribus brevibus distichis, calycibus glabris ovarii basi adnatis margine libero truncato, staminibus sterilibus integris v. vix emarginatis, ovario glabro.—Folia 4-6-pollicaria. Racemi vix semipollicares, floribus circa 10 albis.—In monte Padawan Guianæ Anglicæ leg. Schomburgk.

O. pauciflora, sp. n., foliis ovatis junioribus ramulis pedicellisque puberulis, pedunculis axillaribus 1-3-floris, calycibus molliter pubescentibus ovarii basi adnatis margine libero brevissimo truncato, staminibus sterilibus longe bifidis, ovario villoso.—Serra Acurua provinciæ Bahiensis, Brasiliæ, Blanchet, n. 2795. An huc Dulacia singularis Vell. Fl. Flum. 1. t. 78. ?

Among the species enumerated in Wallich's List, n. 6777. *O. lucida* appears to be *O. Wightiana* ; n. 6778. *O. Bador* is correctly referred by Wight and Arnott to *O. scandens* ; n. 6780. *O. Heyneana* is *Gomphandra polymorpha*, Wight ; and n. 6782. *O. longifolia* is *Gomphandra axillaris*, at least the letter A ; the letter B may perhaps be a different species of *Gomphandra*.

† Of this genus I have examined *S. fragrans*, Wall., in flower and fruit, and a Brasilian species, in flower only, from Serra Jacobina (Blanchet, n. 2593), perhaps *S. arborescens*, but my materials do not at present admit of my determining the species with certainty.

Tribe II. OPILIEÆ.

Ovarium a basi uniloculare. *Ovulum* (saltem per anthesin) unicum, minimum, ab apice placentæ liberæ centralis pendulum. *Stylus* centricus. *Semen* spurie erectum. *Inflorescentia* axillaris, racemosa.

5. OPILIA*. *Calyx* minimus. *Petala* 4, 5, libera, decidua. *Stamina* hypogyna, fertilia tot quot petala et iis opposita, sterilia totidem petalis alterna squamæformia. *Stylus* brevissimus. *Stigma* truncatum.

6. CANSJERA†. *Calyx* minimus. *Petala* 4 (rariùs 5 ?) in corollam gamopetalam diu persistentem coalita. *Stamina* Opiliæ. *Stylus* longior; *stigmate* crasso lobato.

Tribe III. ICACINEÆ.

Ovarium a basi uniloculare v. excentrice et complete triloculare. *Ovula* in quoque loculo duo ab apice placentæ hinc ovario adnatæ collateraliter affixa pendula, in loculo superposita, funiculo altero elongato. *Stylus* excentricus. *Semen* pendulum. *Inflorescentia* cymosa, axillaris v. terminalis.

7. GOMPHANDRA‡. *Flores* abortu unisexuales. *Calyx* parvus immutatus. *Petala* 4. *Stamina* in maribus tot quot petala et iis alterna, omnia fertilia clavæformia antheris innatis, sterilia nulla. *Inflorescentia* axillaris, in maribus cymosa, in fœmineis simplex?

8. ICACINA§. *Flores* hermaphroditi. *Calyx* parvus immutatus. *Petala* 5. *Stamina* totidem iis alterna, sterilia nulla. *Ovarium* 1-loculare. *Fructus* ovoideo-oblongus. *Inflorescentia* terminalis.

* *Opilia amentacea*, Roxb., indifferent specimens, in flower only; and excellent specimens, in flower also, of *O. celtidifolia*, or *Groutia celtidifolia*, Guillem. Fl. Senegamb., p. 101. t. 22, gathered by Kotschy in Æthiopia, n. 471. The two species certainly appear to differ in the form of the leaves as well as that of the bracteæ. All the specimens I have seen of *O. acuminata*, Wall., are in too bad a state for examination.

† *Cansjera Rheedii*, Gmel. (*C. malabarica*, Lam., *C. scandens*, Roxb.), in flower and fruit.

‡ *Gomphandra polymorpha*, Wight, *G. axillaris*, Wall., and *G. Penangiana*, Wall., all male flowers only. So far as these go I see no reason to doubt their being congeners to each other. I have seen neither female flowers nor fruit, but they are described by Wight, Illustr. pp. 102–3.

§ This character is taken from Adr. de Jussieu's description and plate in the *Mémoires de la Société d'Hist. Nat.* of Paris, vol. i. p. 174.

9. APODYTES*. *Flores* hermaphroditi. *Calyx* parvus, immutatus. *Petala* 4—5. *Stamina* totidem, iis alterna, sterilia nulla. *Ovarium* 1-loculare. *Fructus* ovato-reniformis subcompressus, hinc appendice carnosa auctus. *Inflorescentia* terminalis.

10. LERETIA†. *Flores* hermaphroditi v. abortu masculi. *Calyx* parvus, immutatus. *Petala* 5, intus villosa. *Stamina* totidem, iis alterna, sterilia nulla. *Ovarium* 1-loculare. *Fructus* (ex icone Fl. Flum.) depresso-globosus. *Inflorescentia* axillaris, laxa.

11. POGOPETALUM‡. *Flores* hermaphroditi. *Calyx* parvus (fructifer parum auctus?) *Petala* 4—5, intus villosa. *Stamina* totidem, iis alterna, sterilia nulla. *Ovarium* triloculare. *Fructus* depresso-globosus? *Inflorescentia* axillaris, densa.

Among the above genera, *Schœpfia* is, I believe, here placed for the first time. It has usually been referred to some of those orders in which the corolla is essentially, or at least usually, gamopetalous and the ovary adnate. De Candolle§ adds it to *Loranthaceæ*, from which it is far removed by the

* *A. dimidiata*, described below.

† *L. cordata*, Velloso, Fl. Flum. iii. t. 2. I am indebted to Mr. Miers for a flowering specimen of this hitherto undescribed genus, from which, as well as from Mr. Miers's notes, I have drawn up the above generic character and the following specific description:—

Frutex. *Ramuli* glabri, subangulati, cortice laxo verrucoso. *Folia* oblongo-elliptica 4-6-pollicaria obtusa v. breviter acuminata, margine integerrima nunc undulata v. irregulariter sinuata, basi obtusa v. breviter cuneata, tenuiter coriacea, glabra, irregulariter penninervia et reticulato-venosa, petiolo semipollicari. *Paniculæ* axillares, laxæ, bis terve ramosæ, multifloræ, folio dimidio breviores. *Bracteæ* nullæ. *Pedicelli* flore parum breviores, apice sub flore articulati, bracteis ad articulationem 2 minutis deciduis. *Calyx* minimus, patens, 5-fidus, laciniis acutis. *Corolla* 2 lin. longa. *Petala* crassiuscula, oblonga, extus minute tomentella, intus medio longitudinaliter barbata. *Stamina* petalis breviora; filamentis ut primum corollæ adhærentibus demum liberis, glabris. *Antheræ* ovatæ, versatiles, glabræ. *Ovarium* in disco crassiusculo sessile, ovoideum, villosum, ovulis prope apicem hinc affixis. *Stylus* excentricus filiformis apice incurvus, stigmate obliquo integro. *Drupa* (ex icone citata) major quam in cæteris Olacineis, depresso-globosa. *Semen* unicum, subcordatum, unde forte nomen specificum Vellosianum.

Emmotum fagifolium, Desv. (in Hamilt. Prod. Fl. Ind. Occid.), may possibly be a *Leretia* or a *Pogopetalum*, but cannot be determined from his very imperfect character.

‡ *P. orbiculatum* and *acuminatum*, described below. I have not seen the ripe fruit.

§ *Prodromus*, vol. iv. p. 319.

structure of the ovary; Endlicher* associates it with *Symplocos*, from which it differs in the æstivation of the corolla and the ovary incompletely divided, two points in which it agrees remarkably with *Olax* and *Ximenia*. The objection as to the adherence of the ovary entirely loses its force, when it is considered that the greater part of that organ as well as the margin of the calyx are free, and that an adherence almost as complete exists in some species of *Olax*. The gamopetalous corolla is also a character of little consequence in orders where the æstivation is valvate, and it exists to a considerable degree in *Olax* itself. The stamens of *Schœpfia* are more closely adherent to the corolla than in other *Olacineæ*, but the filaments are filiform and prominent from the base of the corolla, and not confounded with its substance, as in those orders where they are truly epipetalous†.

Cansjera has been usually referred to *Thymeleæ*, from which it differs in the nature of the floral envelopes, in the position of the stamens, in the structure of the ovary, and in that of the fruit; and in all these points it agrees with *Opilia*, from which it differs only in the coherence of the petals.

The close affinity of *Apodytes* to *Icacina* will be evident from a comparison of my figure and description with those of Adr. de Jussieu. *Pogopetalum* differs, however, in the compound nature of the ovarium; but each cell with its ovules is so exactly the single cell of *Apodytes*, and the flowers agree so well with the general character of *Olacineæ*, that the approximation will not be found, it is believed, to violate materially any important natural affinity. It is true that the ripe fruit and seed are as yet unknown, which leaves some doubt on the matter, though it does not occur to me that it comes near to any other order. *Leretia* is in almost all respects intermediate between *Icacina* and *Pogopetalum*.

It will be observed, however, that the three groups, which I have designated as tribes, present some material differences from each other, especially in the structure of the ovary, and may perhaps, when better known, be considered as so many distinct orders. But with our present imperfect knowledge of several genera, and considering their evident connexion in many material points, I

* *Genera Plantarum*, p. 744.

† Mr. Brown informs me that he considers *Schœpfia* as a true Santalaceous and not an Olacineous genus; at all events, it is an additional proof of the close affinity of the two orders.

have thought it more convenient to keep them together under the general character above given. Those species of *Olax* in which the dissepiments of the ovary are almost obliterated form the connexion with *Opilieæ*, and, as far as known to me, *Gomphandra* appears to join *Opilieæ* with *Icacineæ*, whilst *Pogopetalum* is in many respects equally allied to *Olaceæ* and *Icacineæ*.

The first tribe, where the double nature of the floral envelopes is most evident and complete, is that which comes nearest to the various polypetalous orders, with which *Olacineæ* have been compared. But among these, I cannot admit the affinity to *Aurantiaceæ*. The structure of the seed, where it is so constantly and materially different as in these two orders, becomes one of the most important characters in the classification of Dicotyledons; and it is here accompanied by considerable differences in the fruit, in the ovary, in the æstivation of the corolla, in the texture of the vegetable organs, and other points of habit. And those peculiarities, in which *Aurantiaceæ* appear to resemble *Olacineæ*, such as the tendency of the petals to cohere by means of the stamens, the persistent calyx, &c., occur in other orders which are less removed by essential characters.

Meliaceæ, nearly allied to *Aurantiaceæ*, are about equally distant from *Olacineæ* in essential characters, and more so in habit.

Humiriaceæ, a small order usually associated with *Meliaceæ* and *Aurantiaceæ*, differ from them in habit, in the ovary, the fruit and the seed; in all of which points they approach much to *Olacineæ*. The dissepiments of the ovary are, when young, not quite complete, and the embryo lies in the axis of a copious albumen. They differ chiefly from *Olacineæ* in the æstivation of the corolla, which is not so decidedly valvate, in the stamens often indefinite in number, in the dilatations of the connectivum of the anther, the presence of a disc round the ovary, the fruit more generally plurilocular, and the larger embryo with a long radicle; but, upon the whole, they are probably, among dichlamydeous plants, those which come nearest to *Olacineæ*.

*Styraceæ**, which are perhaps more allied to polypetalous orders than to those which are essentially gamopetalous, are very near also to *Humiriaceæ* as well as to *Olacineæ*. The structure of the fruit and seeds may indeed be compared to those of *Schœpfia*, that of the ovary in some respects to *Pogope-*

* Including *Symploceæ* and *Halesiaceæ* of Don. Vid. Trans. Linn. Soc. Lond., vol. xviii. p. 230.

talum. Yet the imbricate æstivation of the corolla, the stamens often indefinite, the structure of the ovary, &c., will remove them at least as far from *Olacineæ* as *Humiriaceæ.*

Corneæ, and some other allied albuminous orders, have also some resemblance to *Olacineæ*; but the essentially and completely adnate ovarium, the epigynous disc, the ovules suspended from the apex of the cells, etc., remove them much farther than the two last-mentioned orders.

In the second tribe of *Olacineæ*, the *Opilieæ*, where the calyx is reduced to little more than a dilatation of the torus, we have the nearest approach to the *Santalaceæ*; and, if it be admitted that there are true Santalaceous genera with a superior ovary, and if I am right in supposing that in the young bud of *Opilia* and *Cansjera* there is more than one ovule, then these two genera become so nearly intermediate between *Olaceæ* and *Santalaceæ* as to have nearly as much claim to be associated with the latter as with the former. Indeed it appears to me, from dried specimens, that the structure of the ovule in *Opilieæ,* very different from that of *Olaceæ*, is very similar to that of *Thesium.* Thus, whilst a considerable gap is observable between *Olacineæ* and the nearest allied of the Dichlamydeous orders with which they have been compared, the close connexion with *Santalaceæ* is completely established through the Australian species of *Olax* and the *Opilieæ.*

The third tribe, the *Icacineæ,* intimately connected with the two preceding ones in most respects, recede from them in some remarkable points, especially in the adherence of the placenta to one angle of the ovarium, and the seed, which is consequently pendulous, not erect. I should therefore have proposed them as a separate order, were it not for the remarkable resemblance to some true Olacineous genera in the arrangement of the floral parts, without any distinctive character of importance, other than the one above mentioned.

I now add the detailed characters of the two new genera figured:—

Apodytes, *E. Meyer.*

Calyx minimus, 5-dentatus, liber, persistens, fructifer immutatus. *Corolla* hypogyna, petalis 5, oblongo-linearibus, æstivatione valvatis, intus glabris, basi inter se et cum staminibus coalitis. *Stamina* 5, petalis alterna,

corolla breviora, omnia fertilia. *Filamenta* basi dilatata, glabra. *Antheræ* introrsæ, sagittatæ, medifixæ, biloculares, loculis longitudinaliter dehiscentibus. *Ovarium* liberum, semiovoideum, uniloculare, ovulis 2 subcollateraliter affixis, in loculo superpositis. *Stylus* excentricus, basi geniculatus, erectus; stigmate minuto truncato. *Drupa* baccata, dimidiato-ovato-reniformis, stylo hinc coronata et lateraliter appendice carnosa aucta; nucleo osseo monospermo. *Semen* pendulum, ovato-reniforme, compressum, testa tenui, albumine copioso carnoso nigro. *Embryo* in medio albuminis parvus, axilis, juxta hilum positus, rectus, radicula brevi ad hilum spectante.

A. dimidiata, E. Meyer, MSS. Tab. XLI.

Arbor? v. frutex? cortice griseo, ramulis angulatis pubescentibus. *Folia* exstipulata, alterna, petiolata, ovali-elliptica v. oblonga, $1\frac{1}{2}$–2-pollicaria, obtusa, integerrima, basi rotundata v. cuneata, perennantia, supra glabra, nitida, subtus pube rara conspersa. *Paniculæ* terminales, laxe ramosæ, folia subæquantes. *Bracteæ* minimæ, ovatæ v. lanceolatæ. *Flores* vix ultra lineam longi. *Calyces* minute puberuli. *Corolla* glabra. *Fructus* (a calyce ad basin styli) 2 lin. longus, cum appendice carnosa 4 lin. latus.

From Port Natal in South Africa. *Drège, Lieut. Peddie, Krauss.*

Pogopetalum.

Calyx brevissimus, 5-, rarius 4-dentatus, liber, fructifer immutatus. *Petala* tot quot dentes calycini, æstivatione valvata, intus a basi ad apicem linea dense barbata aucta. *Stamina* tot quot petala, iisque alterna et breviora. *Filamenta* basi dilatata, cum petalis subcohærentia. *Antheræ* introrsæ, sagittatæ, biloculares, loculis longitudinaliter dehiscentibus. *Ovarium* liberum, globosum, loculis 3 ab uno latere nec a centro radiantibus, ovulis in quoque loculo subcollateraliter affixis, in loculo superpositis. *Stylus* brevis, excentricus; stigmate parvo obscure trilobo. *Drupa* globosa, abortu unilocularis. *Semina* ......

Frutices Guianenses, foliis alternis coriaceis exstipulatis, cymis axillaribus brevibus densis multifloris.

P. orbiculatum, foliis ovato-orbiculatis obtusissimis subtus ramulisque incanis, ovario hispido.

Frutex 10–12-pedalis, divaricato-ramosus. *Folia* 4-pollicaria, supra nitida, venis utrinque 6 parallelis prominentibus. *Flores* fere 2 lin. longi. *Fructum* unicum nondum maturum depresso-globosum vidi.

Dry savannahs on the Padawire river. *Schomburgk.*

P. acuminatum, foliis ovatis oblongisve acuminatis subtus vix pallidioribus, ovario glabro.

Folia 3–4-poll. longa. *Flores* minores, laxiores quam in præcedente.

This is, according to Schomburgk, a tree of about 30 feet high, growing on the high banks of the Rio Negro; the flowers are pure white. *Schomburgk. n.* 970.

EXPLANATION OF THE PLATES.

TAB. XLI.

Fig. 1. *Apodytes dimidiata.*
2. Flower.
3. Ditto, laid open, showing the position of the stamina.
4. Pistillum.
5. Ovarium, cut vertically.
6. Ditto, cut transversely.
7. Mature fruit.
8. Ditto, ditto, cut vertically, showing the seed with its albumen and embryo.

TAB. XLII.

Fig. 1. *Pogopetalum orbiculatum.*
2. Flower unexpanded.
3. Ditto, laid open, showing the position of the stamina.
4. Pistillum.
5. Vertical section of the ovarium.
6. Transverse section of ditto.
7. Superior ovulum.
8. Inferior ditto.

del.

G. Jarman sc

XLIV. *Extracts from the* MINUTE-BOOK *of the* LINNEAN SOCIETY *of* LONDON.

1837.

Nov. 21. READ the following "Notice of the discovery of *Cucubalus baccifer*, L., in the Isle of Dogs." By Mr. George Luxford, A.L.S.

"The accompanying specimen of *Cucubalus baccifer* was, with many others, collected by me in the Isle of Dogs in the early part of last August. This plant was originally introduced into the British Flora by Dillenius in the third edition of Ray's Synopsis. He there speaks of it as having been gathered in hedges in Anglesea (Mona) by Mr. Foulkes of Llanbedu, and sent by him to Dr. Richardson; but in a letter from Mr. Foulkes to the latter gentleman, published in the Linnean Correspondence, vol. ii. p. 171, he states, that he only had 'an account of it from one who pretended to know plants very well,' but 'that he himself could find no such plant.' In a note to this letter, in the work just mentioned, Sir J. E. Smith says, 'Nobody, as far as I could learn, has ever met with the plant since, except in curious botanic gardens, in any part of the British isles; and accordingly I was obliged to be content with a garden specimen for the figure in English Botany, tab. 1577. I am, therefore, under the necessity, however unwillingly, of excluding the *Cucubalus baccifer* from our British Flora.' It was accordingly omitted when Sir James published his 'English Flora.'

"The locality in the Isle of Dogs is on the banks of the ditch on the left hand of the road from Blackwall to the Ferry House; and there, if not truly indigenous, it is at least perfectly naturalized. I also feel convinced that I have met with it in similar situations in other parts of England; but the plant not being in flower, I have passed it, as I did the first time I saw it in the Isle of Dogs, thinking it to be merely *Cerastium aquaticum*. It is probable that, like *Polygonum dumetorum*, this plant only requires to have the attention of botanists

directed to it to lead to its discovery in other localities; and I shall be happy if my meeting with it so near London may be the means of getting it restored to the British Flora, where it certainly is at least as much entitled to a place as *Centranthus ruber*, *Petroselinum sativum*, and other avowedly naturalized plants."

1838.

June 19. Read a "Description of a new Species of *Cattleya*." By R. H. Schomburgk, Esq. Communicated by Professor Lindley, F.L.S.

Mr. Schomburgk's figure and description of this plant, to which he gives the name of *Cattleya superba*, have since been published by Professor Lindley in his *Sertum Orchidaceum*, t. 22.

Nov. 6. The Vice-President in the Chair announced to the Meeting, that the late Nathaniel John Winch, Esq., A.L.S., of Newcastle-upon-Tyne, had bequeathed to the Society his entire Herbarium, consisting of upwards of 12,000 species of Plants, together with his Library of Natural History.

Read a "Notice of the occurrence of *Procellaria Wilsoni* on the British Coast." By Jonathan Couch, Esq., F.L.S.

Mr. Couch states, that "about the middle of August of the present year, the Stormy Petrel, *Proc. Pelagica*, abounded on the south coast of Cornwall, driven thither, it is probable, by about a week's continuance of wind accompanied by rain; under which circumstances they are commonly found by thousands at a few miles from land, in the months of September and October. It is probable that the weather, as described above, had driven to us this rare stranger, the first of its species I believe on record as having occurred in Britain, which was found at the same time dead in a field at a few miles from Polperro, and was brought to me for examination. As our sailor boys were in possession of numerous living specimens of the Stormy Petrel, which are taken with great facility when the weather suits, I found no difficulty in instituting a comparative examination of these two species; and I beg leave to lay the result before the

Linnean Society. Both the specimens were in about equal degrees well fed :—

Weight of the Stormy Petrel	4 drams 35 grains ;	of Wilson's Petrel 5 drams 2 scruples.
Length ,, ,,	6 inches ;	,, ,, 7 inches.
Spread of the wings ,,	14½ inches ;	,, ,, 16½ inches.
The wings extend beyond the tail	½ an inch ;	,, ,, 1½ inch.
With the legs extended, the toes extend, short of the end of the tail	1 line ;	beyond the tail ½ inch 2 lines.

"The Stormy Petrel is feathered just to the tarsal joint ; but in Wilson's Petrel the feathers only approach within 4 lines of it. In the former the tarsus is in length 1 line short of an inch, in the latter 1 inch 4 lines, and equally slender with the former ; and the hinder toe is so minute, that it might escape any but attentive examination. In the bill the markings are more strongly defined, with the terminal hook longer and sharper. The prominence of the forehead is less than in the more common species. Colour of the head black, with a tint of hoary, lighter on the throat. The back, belly, wings and tail ferruginous, lighter on the wing-coverts ; the rump white, and a little of the same at the vent. Tarsi and feet black, with a longitudinal stripe of sulphur-yellow, more golden at the borders, on the web between each toe.

"This species, being of a stouter configuration than the common Petrel, is probably better able than it to escape the violence of a storm ; the reason, perhaps, why it does not more frequently come near our coasts. But something also may be ascribed to the manner of its flight ; that of the Stormy Petrel resembling the hovering motion of a Bat, and thus going before the violence of a gale, rather than counteracting its influence. As the minuter actions of these birds are so little known, it may be interesting to add, that in examining the stomach of a Stormy Petrel, about the length of half an inch of a common tallow candle was found, of a size so disproportioned to the bill and gullet of the bird, that it seems wonderful how it could have been able to swallow it. It is remarked, that when

any greasy substance offers itself on the surface of the sea, too large to be readily swallowed, the Petrel with wings expanded runs backward, until the whole is gorged or a fragment torn away."

Dec. 18. Read the following "Notice of *Cereus tetragonus*." By Edward Rudge, Esq., F.L.S.

"This plant, which has been constantly kept in my hot-house upwards of twenty years, is a single stem between nine and ten feet in height from the roots. The stem next the roots and for about a foot from thence is solid and four-sided, about three inches in width, with spines at its blunt angles; at the height of between three and four feet it becomes pentagonous, lobed at the angles, and within a foot and a half of the top it is hexagonous. It first began to bloom in the autumn of 1836, when it put out nineteen blossoms, opening soon after sunset, and closing again soon after sunrise. In the autumn of 1837 it produced eleven blossoms, and in 1838 thirteen flowers, chiefly near the top of the plant, one or two only appearing near the lower part, but all of them growing from the angles of the lobes and stem. The colour of the petals is white, slightly tinged with green at the base. The anthers are yellow."

A sketch of the flower, of the natural size, accompanied the notice.

1839.

May 24. A Portrait of William Yarrell, Esq., F.L.S., painted by Mrs. Carpenter, was presented to the Society by the under-mentioned Gentlemen: viz.

The Bishop of Norwich.
R. Brown, Esq.
E. Forster, Esq.
—. Andrews, Esq.
The Rev. J. Barlow.
T. Bell, Esq.
J. J. Bennett, Esq.
—. Bentley, Esq.
J. E. Bicheno, Esq.
J. S. Bowerbank, Esq.
Lord Braybrooke.
W. J. Broderip, Esq.
—. Carpenter, Esq.
J. G. Children, Esq.
The Earl of Derby.
G. T. Fox, Esq.
J. E. Gray, Esq.
J. H. Gurney, Esq.

C. Harrison, Esq.
W. Harrison, Esq.
The Rev. F. W. Hope.
The Rev. L. Jenyns.
—. Jesse, Esq.
Rymer Jones, Esq.
W. H. Lloyd, Esq.
J. Martin, Esq.
J. Milne, Esq.
J. Morgan, Esq.
—. Moule, Esq.
J. Murray, Esq.
J. Murray, Jun., Esq.
W. Ogilby, Esq.
R. Owen, Esq.
P. J. Selby, Esq.
R. H. Solly, Esq.
R. Taylor, Esq.
W. Thompson, Esq.
Dawson Turner, Esq.
—. Van Voorst, Esq.
—. Willimott, Esq.
J. Wilson, Esq.

Dec. 3. Read "Descriptions of some Vegetable Monstrosities." By the Rev. W. Hincks, F.L.S.

Two of these monstrosities occur in species of *Iris*. The first is in a flower of *Iris versicolor*, having 5 outer reflexed segments, 4 inner upright segments, 5 stamens, 5 distinct stigmas, and a 5-celled ovarium. It is evident that this superfluity of parts originates in the union of two flowers: the line of junction of the flower-stalks may be distinctly traced; and the composition of the ovarium is equally obvious, three of the carpels belonging to one flower and two to the other. Mr. Hincks states that this exactly corresponds with the case of some monstrous *Œnotheræ*, in which he has observed 7 petals, 14 stamens, and 7 stigmas, but where no line of junction of the two flowers of which he supposes them to be made up is visible. In all these cases one part of each circle is sacrificed in the union of the two flowers, except in the inner segments of the *Iris*, where one part of each flower is lost. In the second case, occurring in a flower of *Iris sambucina*, 3 segments of the inner series only remain, while there are 5 parts in all the other circles: the line of junction is much less evident than in the former, but may be observed in the ovarium and tube of the perianthium.

Mr. Hincks compares these cases with monstrosities in his collection of *Narcissus elatior* and *Salpiglossis straminea*; in the former of which two flowers adhere, and are both perfect, the united petals and nectaries separating one from the other; while in the latter

the two flowers are completely united into one, with a double number of parts in each of the circles. But the most remarkable instance of this kind of union with which he has met occurs in a specimen of *Scrophularia nodosa*, found at Water Fulford, near York, in which four flowers are united into one. In this case several monstrous flowers occur on the same branch, but are generally unions of only two flowers, and the terminal flowers are invariably of the ordinary structure. This Mr. Hincks regards as what might be expected in a plant with centrifugal inflorescence, where the monstrosity consists of a union of flowers; whereas in the same kind of inflorescence, when the monstrosity consists in a more full and equal development, the central flower might be expected to be the first affected; and this actually occurs in a specimen which he possesses of a species of *Linaria* with all the terminal flowers (and those alone) *peloriated*.

In the stalk of the flower of *Scrophularia nodosa* referred to, Mr. Hincks thinks he can recognize the junction of 4 peduncles; the number of sepals is 15, one of them being narrow and somewhat displaced; that of the petals, which all cohere together, 16. Of these, 7 are the lower or more developed petals, which are upright in the limb and are united in pairs. These are altogether in one line at the back of the flower, and the position of a stamen shows the suppression of one part where the additional sepal has been preserved. Of the upper or reflexed petals only 9 remain; and as there are 3 of these in each ordinary flower, if one be supposed to have perished at each juncture, according to the analogy of the *Irides* and *Œnotheræ*, the whole number will be accounted for. The number of stamens is 20, or 5 to each flower; one of these has its anther abortive and changed into a scale, and there are several instances of two being united together, but all may be distinctly traced. There are three distinct ovaria, two of which belong each to one flower, having the usual bilocular structure; the third Mr. Hincks regards as manifestly belonging to two flowers, but made up of 8 cells instead of 4. He found several 3-locular ovaria on the same plant; but in this instance he believes there are 4 cells developed for each flower, their

number approaching that of the external circles. The general figure of the monstrous flower is somewhat reniform.

1840.

June 16. A Portrait of Dr. Boott, late Secretary of the Society, painted by Mr. Eddis, was presented by the under-mentioned Fellows :—

The Bishop of Norwich.
Robert Brown, Esq.
Edward Forster, Esq.
John J. Bennett, Esq.
Arthur Aikin, Esq.
Thomas Bell, Esq.
George Bentham, Esq.
Thomas Bevan, Esq.
J. E. Bicheno, Esq.
William Borrer, Esq.
J. E. Bowman, Esq.
Walter Buchanan, Esq.
I. L. Goldsmid, Esq.
J. A. Hankey, Esq.
William Harrison, Esq.
Sir William J. Hooker.
Joseph Janson, Esq.
W. H. Lloyd, Esq.
Charles Lush, M.D.
John Martin, Esq.
Archibald Menzies, Esq.
Joshua Milne, Esq.
Thomas Bell Salter, M.D.
Daniel Sharpe, Esq.
R. H. Solly, Esq.
Charles Stokes, Esq.
Richard Taylor, Esq.
N. B. Ward, Esq.
William Yarrell, Esq.

CATALOGUE

OF THE

LIBRARY OF THE LINNEAN SOCIETY.

Continued from page 588 of Vol. XVII. of the Society's Transactions.

N.B. To Books which are Continuations of Works included in any of the former Parts of the Catalogue, the original Numbers are here affixed; and the other Books are numbered in regular progression.

1968. Acharii (E.) Methodus Lichenum. Stockholmiæ, 1803, 8vo. (with MSS. Notes and Additional Figures, by the late Rev. John Harriman, F.L.S.).

1969. Agardh (C. A.) Species Algarum rite cognitæ, vol. 1, & vol. 2, part 1, 8vo. Gryphiswaldiæ, 1823—8, 8vo.

1970. Aikin's (A.) Manual of Mineralogy. London, 1814, 8vo.

1971. Arnott (G. A. W.) Pugillus Plantarum Indiæ Orientalis. (*Ex Act. Acad. Cæs. Nat. Cur. tom.* 18.) 1836, 4to.

1636. Babington's (C. C.) Supplement to the Flora Bathoniensis. 1839, 12mo.

1972. ——————— Primitiæ Floræ Sarnicæ; or, an Outline of the Flora of the Channel Islands. London, 1839, 12mo.

1973. Baines's (H.) Flora of Yorkshire. London, 1840, 8vo.

1974. Baird's (J.) Address to the Berwickshire Naturalists' Club, read at its sixth anniversary meeting, Sept. 20th, 1837. 8vo.

1975. Ball's (R.) Rough Sketches intended to aid in developing the Natural History of the Seals of the British Islands. fol.

1976. Barton's (B. S.) Memoir concerning an animal of the class of Reptilia, or Amphibia, known in the United States by the names of Alligator and Hell-bender. Philadelphia, 1812. 8vo.

1640. Baxter's (W.) Figures and Descriptions of British Flowering Plants, nos. 54—101. Oxford, 1837—40. 8vo.

1977. Bell's (T.) History of British Quadrupeds, including the Cetacea. London, 1837 8vo.

1978. ——— History of British Reptiles, part 3. London, 1839, 8vo.

1979. Bellardi (L.) e Michelotti (G.) Saggio Orittografico sulla classe dei Gasteropodi fossili dei terreni tertiarii del Piemonte. Torino, 1840, 4to.

1980. Bennett's (J. W.) Coco-nut Tree, its Uses and Cultivation, 2nd edition. London, 8vo.

1981. Bentham (G.) Commentationes de Leguminosarum generibus. Vindobonæ, 1837, 4to.

1982. ———— Plantæ Hartwegianæ. Londini, 1839, 8vo.

1983. Berkeley's (M. J.) British Fungi, consisting of Dried Specimens of the Species described in vol. 5. of the English Flora. Fasc. 1—3. London, 1836—7, 4to.

1647. Bertolonii (A.) Flora Italica, tom. 2, fasc. 3—6, tom. 3, & tom. 4, fasc. 1 & 2. Bononiæ, 1836—9, 8vo.

1984. ———— Disquisitio de quibusdam plantis novis aliisque minus cognitis. Bononiæ, 1832, 4to.

1985. ———— Dissertatio de quibusdam novis Plantarum speciebus et de Bysso antiquorum. Bononiæ, 1835, 4to.

1986. ———— Commentarius de Mandragoris. Bononiæ, 1835, 4to.

1987. ———— Descrizione di un nuovo genere e di una nuova specie di pianta Gigliacea. Modena, 1835, 4to.

1988. ———— Continuatio Historiæ Horti Botanici et Scholæ Botanicæ Archigymnasii Bononiensis, adjectis descriptionibus trium novarum plantarum. Bononiæ, 1827, 4to.

1989. ———— Commentarius de itinere Neapolitano æstate anni 1834 suscepto. Bononiæ, 1837, 4to.

1990. ———— Horti Botanici Bononiensis plantæ novæ vel minus cognitæ, fasc. 1 & 2. Bononiæ, 1838—9, 4to.

1991. Bevan's (E.) Honey Bee, its Natural History, Physiology, and Management. London, 1838, 12mo.

1992. Bischoff (L. W. F.) De vera Vasorum Plantarum Spiralium structura et functione commentatio. Bonnæ, 1829, 8vo.

1993. Blanco (M.) Flora de Filipinas. Manilla, 1837, 8vo.

1994. Bohn's (J.) Catalogue of Ancient and Modern Books. London, 1840, 8vo.

1995. Bojer (W.) Hortus Mauritianus; ou Énumération des Plantes exotiques et indigènes, qui croissent à l'Ile Maurice. Maurice, 1837, 8vo.

1996. Boott's (F.) Enumeration of the Carices of British North America. (*From Hooker's Flora Boreali-Americana, vol.* 2.) 4to.

1997. Boué (A.) Mémoire géologique sur l'Allemagne. (*Extr. du Journ. de Physique, Mai,* 1822.) 4to.

1998. ———— Mémoire sur les Terrains Secondaires du Versant Nord des Alpes Allemandes. (*Extr. des Ann. des Mines,* tom. 9.) Paris, 1824, 8vo.

1999. Bouillet (J. B.) Catalogue des espèces et variétés de Mollusques observés dans la Haute et la Basse Auvergne, etc. Clermont-Ferrand, 1836, 8vo.

2000. Bridel (S. E.) Muscologia Recentiorum, tomi 3. Gothæ, 1797—1801. 4to.

2001. Brown (R.) On Cyrtandreæ. (*From Horsfield's Plantæ Javanicæ Rariores.*) London, 1838—9, fol.

2002. Buckland's (W.) Vindiciæ Geologicæ. Oxford, 1820, 4to.

2003. Burton's (E.) Catalogue of the Mammalia and Birds in the Museum of the Army Medical Department, at Fort Pitt, Chatham. Chatham, 1838, 8vo.

2004. Cacciatore (N.) De redigendis ad unicum seriem comparabilem meteorologicis ubique factis observationibus. Panormi, 1832, 4to.

2005. Carus (C. G.) Needhamia expulsoria Sepiæ officinalis; beschrieben und abgebildet. (*Ex Act. Acad. Cæs. Nat. Cur. vol.* 19.) 4to.

2006. Catesby (M.) Hortus Europæ Americanus. London, 1767, fol.

2007. Charlesworth's (E.) Natural History Illustrations, no. 1. London, 1839, 4to.

2008. Clark (B.) On the Shying and Startlish Horse. 4to.

2009. ——— Testimonies in favour of the Expansion Shoe. London, 1828, 4to.

2010. ——— Description of Two Ancient Horse-Shoes found near Silbury Hill, in Wiltshire. 4to.

2011. ——— Description of the Gripes of Horses, and of a better mode of treating it; also Human Cholera explained, 2nd edition. London, 1837, 4to.

2012. Clarke's (E. D.) Address read at the first meeting of the Cambridge Philosophical Society. Cambridge, 1821, 4to.

2013. Clarke's (J.) Address to the Berwickshire Naturalists' Club, delivered at the anniversary meeting, Sept. 19th, 1838. 8vo.

1671. Colla (A.) Plantæ rariores in Regionibus Chilensibus a M. D. Bertero nuper detectæ, fasc. 2, 6 & 7. (*From Mem. Acad. R. di Torino,* tom. 38 & 39.) 4to.

1673. ——— Herbarium Pedemontanum, juxta Methodum Naturalem dispositum, vol. 2—6. Augustæ Taurinorum, 1834—6, 8vo.

2014. ——— Icones Plantarum Rariorum Herbarii Pedemontani, fasc. 1 & 2. 4to.

2015. Cooper's (D.) Supplement to the Flora Metropolitana. London, 1837, 12mo.

2016. Corda (A. J. C.) Beitrage zur Lehre von der Befruchtung der Pflanzen, translated, with prefatory remarks, by Asa Gray, M. D. (*From the Amer. Journ.*) 8vo.

2017. Couch's (J.) Cornish Fauna, part 1. Truro, 1838, 8vo.

2018. Croom's (H. B.) Catalogue of Plants, native or naturalized, in the vicinity of Newbern, North Carolina, with remarks and synonyms. New York, 1837, 8vo.

2019. ——— Observations on the genus Sarracenia, with an account of a New Species. (*From Ann. of the Lyc. of Nat. Hist.*) New York, 1837, 8vo.

1038. Curtis's (J.) British Entomology, no. 157—192. London, 1837—39, 8vo.

2020. ——— Guide to an arrangement of British Insects, 12mo, 2nd edition. London, 1837.

1158. Curtis's (W.) Botanical Magazine, third series, by Sir W. J. Hooker, vols. 11—14. London, 1837—40, 8vo.

1407. Cuvier (G.) et Valenciennes (A.) Histoire Naturelle des Poissons, tomes 12—15. Paris, 1837—40, 8vo.

2021. Da Costa de Macedo (J. J.) Discorso lido Maio 15, 1838, na sessão publica da Academia Real das Sciencias de Lisboa. Lisboa, 1838, 8vo.

2022. Dahlbom (G.) Conspectus Tenthredinidum, Siricidum, et Oryssinorum Scandinaviæ. Havniæ, 1835, 4to.

2023. ——— Prodromus Hymenopterologiæ Scandinavicæ. Lundæ, 1836, 8vo.

2024. ——— Kort Underrättelse om Skandinaviska Insekters allmännare skada och nytta i hushållningen. Lund, 1837, 8vo.

2025. ——— Jakttagelser öfver Skandinaviens Fjärillar. Lund, 1837, 4to.

2026. Dahlbom (G.) & Ahlgren (J.) Synopsis Hymenopterologiæ Scandinavicæ, häft 1. Lund, 1839—40, 4to.

2027. Dana (J. D.) and Herrick (E. C.) Description of the Argulus Catastomi, a new parasitic Crustaceous animal. (*Read before the Yale Nat. Hist. Soc., New Haven.*) 1836, 8vo.

2028. Darlington's (W.) Flora Cestrica, an attempt to enumerate the Flowering and Filicoid Plants of Chester County, Pennsylvania. West-Chester, Penn., 1837, 8vo.

2029. Daubeny's (C.) Inaugural Lecture on the Study of Botany, read in the Library of the Botanic Garden, Oxford, May 1st, 1834. Oxford, 1834, 8vo.

2030. ——— On the Action of Light upon Plants, and of Plants upon the Atmosphere. London, 1836, 4to. (*From the Phil. Trans.*)

2031. ——— Sketch of the Geology of North America. Oxford, 1839, 8vo.

2032. Davies's (J.) Selections in Pathology and Surgery. London, 1839, 8vo.

1166. DeCandolle (A. P.) Prodromus Systematis Naturalis Regni Vegetabilis, partes 5—7. Parisiis, 1836—9, 8vo.

2033. ——— Observations sur la Structure et la Classification de la Famille des Composées. Paris, 1838, 4to.

2034. ——— Statistique de la Famille des Composées. Paris, 1838, 4to.

2035. ——— Revue sommaire de la Famille des Bignoniacées. (*Tirée de la Bibl. Univ. de Genève, Sept.* 1838.) 8vo.

2036. Delessert (B.) Icones Selectæ Plantarum, voll. 3 & 4. Parisiis, 1837—9, fol.

2037. Delile (A. R.) Mémoire sur le Maclura Aurantiaca, et Essais de nourritures de Vers-à-soie au moyen de ses feuilles. (*Extr. des Bull. de la Soc. d'Agric. du Dept. de l'Hérault,* 1835.) 8vo.

2038. ——— Nouveaux cristeaux parmi les grains de pollen du Caladium bicolor, et Conceptacles des Biforines dans ses fleurs. (*Extr. du même.*) 8vo.

2039. ——— De la Culture de la Patate douce. (*Extr. du même,* 1836.) 8vo.

2040. ——— De la Culture du Crambe maritima. (*Extr. du même.*) 8vo.

2041. ——— Note sur la Culture de l'Oxalis crenata, plante potagère a tubercules radicaux comestibles. (*Extr. du même,* 1836.) 8vo.

2042. Delile (A. R.) Nouvel examen de la Phosphorescence de l'Agaric de l'Olivier. (*Extr. du même*, 1837.) 8vo.

1691. Desjardins (J.) 7ème Rapport Annuel sur les Travaux de la Société d'Histoire Naturelle de l'Ile Maurice. Ile Maurice, 1836, 8vo.

2043. ——— Liste des Membres qui composent la Société d'Histoire Naturelle de l'Ile Maurice.

2044. ——— Notice Historique sur Charles Telfair, Esq. Port Louis, 1836, 8vo.

2045. Dickie's (G.) Flora Abredonensis. Aberdeen, 1838, 8vo.

2046. Dillwyn's (L. W.) Review of the references to the Hortus Malabaricus of H. van Rheede van Draakenstein. Swansea, 1839, 8vo.

2047. ——— Contributions towards a History of Swansea. Swansea, 1840, 8vo.

1422. Don's (G.) General System of Gardening and Botany, vol. 4. London, 1838, 4to.

2048. Donn (J.) Hortus Cantabrigiensis, 7th edition. Cambridge, 1812, 8vo (with notes relating to Mr. Winch's Herbarium).

2049. Dufrenoy (—) et de Beaumont (E.) Notice sur le Gisement, l'Exploitation et le Traitement des Minérais d'Etain et de Cuivre du Cornuailles. 8vo.

2050. Edwards (H. M.) Recherches pour servir à l'Histoire de la Circulation du Sang chez les Annelides. (*Extr. des Ann. des Sc. Nat., tom.* 10.) 1837, 8vo.

1181. Edwards's (S.) Botanical Register, vols. 23—26, *New Series*, continued by Dr. Lindley. London, 1837—40, 8vo.

——— Appendix to ditto, consisting of Alphabetical and Systematical Index, together with a Sketch of the Vegetation of Swan River Colony, by Dr. Lindley. London, 1839, 8vo.

2051. Eichwald (E.) Naturhistorische Skizze von Lithauen, Volhynien, und Podolien. Wilna, 1830, 4to.

2052. Ekströmer (C. J.) Tal om K. Seraphimer—Ordens Lazarettet i Stockholm. Stockholm, 1840, 8vo.

2053. Elliott's (S.) Sketch of the Botany of South Carolina and Georgia, 2 vols. Charleston, S. C., 1821—4, 8vo.

2054. Endlicher (S.) Genera Plantarum, secundum Ordines Naturales disposita, no. 1—10, Vindobonæ, 1836—9, 8vo.

2055. Faraday (M.) on the practical Prevention of Dry-Rot in Timber. London, 1836, 8vo.

1718. Fischer (F. E. L.) et Meyer (C. A.) Index Quartus Seminum quæ Hortus Botanicus Imperialis Petropolitanus pro mutua commutatione offert. Accedunt Animadversiones Botanicæ nonnullæ. 8vo.

1061. Fischer (Gotth.) Entomographie de la Russie, tom. 2. Moscou, 1823, 4to.

2056. ——— Recherches sur les Ossemens Fossiles de la Russie, nos. 1 & 2. Moscou, 1836, 4to.

2057. ——— Oryctographie du Gouvernement de Moscou. Moscou, 1830—37, fol.

2058. Fleming's (J.) History of British Animals. Edinburgh, 1828, 8vo.

2059. Flourens ( ) Eloge Historique d' A. L. de Jussieu. 4to.

2060. Forbes (E.) Malacologia Monensis, a Catalogue of the Mollusca inhabiting the Isle of Man and the neighbouring islands. Edinburgh, 1838, 12mo.

2061. Forsten (E. A.) Dissertatio de Cedrela febrifuga. Lugduni Batavorum, 1836, 4to.

2062. Forster's (T.) Philozoia, or Moral Reflections on the actual Condition of the Animal Kingdom. Brussels, 1839, 8vo.

2063. ——— Pan, a pastoral, with other poems. Brussels, 1840, 8vo.

2064. Francis's (G. W.) Analysis of the British Ferns and their allies. London, 1837, 8vo.

2065. ——— Little English Flora. London, 1839, 8vo.

2066. ——— Grammar of Botany. London, 1840, 12mo.

2067. Fries (E.) Beskrifning på nya Lafslägten. Stockholm, 1822, 8vo.

2068. Fuchsii (L.) Plantarum Effigies. Lugduni, 1551, 12mo.

2069. Gaertner (C. F.) Over de Voortteling van Bastaard Planten. Haerlem, 1838, 8vo.

2070. Glocker (E. F. de) De Graphite Moravico, et de phænomenis quibusdam, originem Graphitæ illustrantibus, commentatio. Vratislaviæ, 1840, 4to.

2071. Göppert (H. R.) De Acidi Hydrocyanici vi in Plantas Commentatio. Vratislaviæ, 1827, 8vo.

2072. ——— Ueber Wärme-Entwickelung in der lebenden Pflanze. Wien, 1832, 8vo.

2073. ——— Ueber den Zustand in welchem sich die Fossilien Pflanzen befinden, und ueber den Versteinerungs-process insbesondere. (*Poggendorff's Annal., bd.* 38.) 8vo.

2074. ——— Dank und Bitte an die Schlesier. (*Verh. der Schles. Ges. für* 1835.) 4to.

2075. Gould's (J.) Synopsis of the Birds of Australia and the adjacent islands, parts 1—4. London, 1837—8, 8vo.

1738. ——— Birds of Europe, parts 19—22. London, 1837, fol.

2076. ——— Birds of Australia, parts 1 & 2. London, 1837—8, fol.

——— ——— 2nd series, part 1. Ibid., 1840, fol.

2077. ——— Icones Avium; or Figures and Descriptions of new and interesting species of Birds from various parts of the globe, parts 1 & 2. London, 1837—8, fol.

1740. ——— Monograph of the Trogonidæ, or Trogons, part 3. London, 1838, fol.

2078. Graham's (J.) Catalogue of the Plants growing in Bombay and its vicinity. Bombay, 1839, 8vo.

2079. Graham's (R.) Notice of Botanical Excursions into the Highlands of Scotland in 1833. (*From Edinb. New Phil. Journ. for Oct.* 1833.) 8vo.

2080. ——— Descriptions of several New or Rare Plants which have lately flowered in the neighbourhood of Edinburgh, and chiefly in the Royal Botanic Garden. 1833, 8vo.

2081. Gray (A.) Melanthacearum Americæ Septentrionalis revisio. (*Ex Ann. Lycæi Hist. Nat. Novi-Ebor., tom.* 4.) Novi-Eboraci, 1837, 8vo.

2082. ——— Remarks on the Structure and Affinities of Ceratophyllaceæ. (*From the Ann. of the Lyceum of Nat. Hist. of New York.*) New York, 1837, 8vo.

2083. Gray's (G. R.) List of the Genera of Birds. London, 1840, 8vo.

2084. Gray's (J. E.) Synoptical Catalogue of the species of certain Tribes or Genera of Shells contained in the Collection of the British Museum and the Author's cabinet; with Descriptions of the New Species. (*From Loudon's Mag. Nat. Hist. vol.* 1, *N. Ser.*) 8vo.

2085. ——— On a New Genus of Land Shells. (*From the same.*) 8vo.

2086. Greenough's (G. B.) Address delivered to the Royal Geographical Society at the Anniversary Meeting, May 25th, 1840. London, 1840, 8vo.

2087. Griffith's (W.) Description of two Genera of Hamamelideæ, two species of Podostemon, and one species of Kaulfussia. (*From Asiat. Res., vol.* 20.) 4to.

2088. ——— On the Family of Rhizophoreæ. 8vo.

2089. ——— Report on the Tea Plant of Upper Assam. (*From Trans. of Agric. Soc. of Calcutta.*) 8vo.

2090. Guillemin (B.) et Dumas (J.) Observations sur l'Hybridité des Plantes en général, et particulièrement sur celle de quelques Gentianes Alpines. (*Mém. de la Soc. d'Hist. Nat. de Paris, tom.* 1.) 4to.

2091. Hacquet (B.) Plantæ Alpinæ Carniolicæ. Viennæ, 1782, 4to.

2092. Hamilton's (F.) Account of the Fishes found in the river Ganges and its branches, 2 vols., 1 of plates. Edinburgh, 1822, 4to.

2093. Hancock's (J.) Observations on the Climate, Soil, and Productions of British Guiana. 2nd edition. London, 1840, 8vo.

1474. Hardwicke (T.) and Gray's (J. E.) Illustrations of Indian Zoology, parts 19 & 20. London, fol.

2094. Harkness's (H.) Ancient and Modern Alphabets of the popular Hindu Languages of the Southern Peninsula of India. London, 1837, 4to.

2095. Harlan (R.) Description of a new species of Fresh Water Tortoise, inhabiting the Columbia River. (*From the Amer. Journ. of Science and Arts, vol.* 31.) 8vo.

2096. Haro (M.) Tableau des Champignons observés dans les environs de Metz. 1er mémoire. Metz, 1838, 8vo.

2097. ——— Notice Anatomique sur le Squale bleu. (*Extr. des Mém. de l'Acad. R. de Metz.*) Metz, 1839, 8vo.

2098. ——— Mécanisme de la Respiration chez quelques Reptiles. (*Extr. du même.*) Metz, 1840, 8vo.

1749. Harrison's (J.) Floricultural Cabinet. London, 1837—40, 8vo.

2099. Harvey's (W. H.) Genera of South African Plants, arranged according to the Natural System. Cape Town, 1838, 8vo.

2100. Henslow's (J. S.) Syllabus of a course of Botanical Lectures. Cambridge, 1828, 12mo.

2101. Hodgson's (B. H.) Indication of a new genus of Insessores tending to connect the Sylviadæ and Muscicapidæ. 8vo.

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2102. Hoeven (J. van der) Recherches sur l'Histoire Naturelle et l'Anatomie des Limules. Leyde, 1838, fol.

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